joaquin valley basin study

california

Prepared by the
U.S. DEPARTMENT OF AGRICULTURE
RIVER BASIN PLANNING STAFF
SOIL CONSERVATION SERVICE FOREST SERVICE
ECONOMIC RESEARCH SERVICE
In cooperation with the
CALIFORNIA DEPARTMENT OF WATER RESOURCES

NOVEMBER
1977

main report
san joaquin valley basin study
california

A Type IV River Basin Study conducted under Section 6 of
The Watershed Protection and Flood Prevention Act
(Public Law 566, 83rd Congress, as amended)

Prepared by
USDA River Basin Staff
Soil Conservation Service
Forest Service
Economic Research Service

In cooperation with the
California Department of Water Resources

November 1977

IRRIGATED VINEYARD WITH COVERCROP

san joaquin valley basin study

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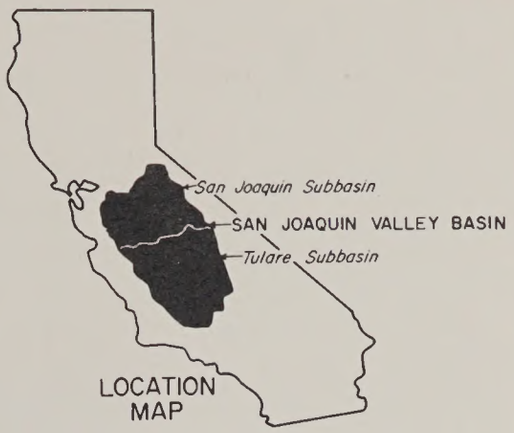

LOCATION MAP

SAN JOAQUIN VALLEY BASIN

CALIFORNIA

SEPTEMBER 1976

10 0 10 20 30 40 MILES

SCALE 1:2,280,000

10 0 10 20 30 40 50 KILOMETERS

Source:
Base map prepared by California State Staff.

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, OR 1976

SAN JOAQUIN VALLEY BASIN
CALIFORNIA

SEPTEMBER 1976

10 0 10 20 30 40 MILES
SCALE 1:2,280,000

10 0 10 20 30 40 50 KILOMETERS

Source:
Base map prepared by SCS, Portland Carto Unit from Landsat 1, Band 7, Mosaic (Formerly ERTS).

RANGELAND

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summary

san joaquin valley basin study

RECREATION LAKE

summary

san joaquin valley basin study

This report is a summary of a USDA study of the San Joaquin Valley Basin. The study identified resource-associated problems and developed alternative plans and a "preferred plan" for solving those problems. Public input and economic projections were used to help identify needs and formulate plans.

The study emphasizes USDA programs. No attempt was made to formulate a master plan for the entire Basin; therefore, problems or issues outside USDA purview or those that can be solved by current programs were not addressed.

This study was conducted in accordance with the U. S. Water Resources Council's "Principles and Standards for Planning Water and Related Land Resources." Using these guidelines, problems were classified as part of an environmental quality objective or a national economic development objective.

A brief summary of the preferred plan is shown in Table i-1.

Identified Problems

Flooding:

Over 2.3 million acres in the Basin are flood prone. A flood in the spring and early summer of 1969 inundated 650,000 acres. Based on 1975 prices, a similar flood today would cause over $143 million in damages. General rainfall floods of late fall and winter cause most of the damage, with average annual flooding costs of about $21 million dollars. This trend is expected to continue in the future.

Poor Drainage

Poor drainage is both a difficult and extensive problem in the Basin, encompassing about two million acres. In the future the problem is expected to intensify. Poorly-drained acreage is expected to increase 2½ times by 2000.

Irrigation Water

Three pressing problems related to irrigation and drainage are boron concentration, irrigation efficiency and groundwater quality; collectively they pose the most difficult of the Basin's problems. Groundwater will continue to be heavily relied on for irrigation. This will create further degradation and lowering of the water table. Poor quality groundwater used for irrigation will compound the salt concentration problems.

Other Water Management

Located in the Pacific Flyway, the northwestern part of the Basin is a major waterfowl wintering area. Wetland habitat is provided by State and Federal wildlife areas and private landowners. Agricultural development has reduced the amount of wetland habitat.

Warm water fisheries in the Basin are most affected by low river flows and fluctuations in reservoirs. The valley floor has a good climate for commercial warm water fisheries but little development has occurred.

Developed Campsites

The projected supply of developed campsites is expected to fall short of meeting expected future demand by an anticipated 4,000 campsites by the year 2000.

Timber Production

The current timber harvests now average 80 million cubic feet per year. By the year 2000, demand for Basin timber is expected to exceed timber production by 20 million cubic feet. Timberlands in the Basin have the capacity to meet this projected demand through intensification of management.

Wilderness Preservation

The desire for wilderness retention has become pronounced in recent years. However, the current supply may decline by 300,000 acres by the year 2000.

Range Forage

Over 80 percent of the Basin's range has problems of overgrazing, low soil fertility, declining productivity, erosion, declining watershed values and water quality problems. Forage production is about 57 percent of potential. This condition is expected to deteriorate. The problems vary from an overgrazing problem to range that is invaded by woody plants, and is therefore essentially useless to livestock.

Erosion and Sedimentation

Moderate to severe sheet, gully and wind erosion problems affect over two million acres of the Basin. Streambank erosion on the other hand is a major sediment producer with about 800 miles of streams having moderate to severe erosion. Sedimentation reduces the capacity of stream channels and reservoirs. It causes flooding, destroys cropland, deposits sediment and debris, and destroys fish spawning by covering or clogging gravel beds.

Deer Habitat

Deer habitat is an important wildlife problem. The current inventory of 6.9 million acres is deteriorating in terms of both acreage and quality. About 1.9 million acres of present deer habitat is expected to be lost by the year 2000.

Wildfires

The annual burned over area in the Basin is 35,000 acres. Fires destroy timber, range, recreation areas, wildlife habitat, and watersheds; and present a constant threat to life and property. Large fires are more damaging than small fires and do nearly 90 percent of the fire damage in the Basin. It is expected that both the number of fires and acres burned will increase in the future.

TABLE i-1. SUMMARY OF PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

COMPONENTS	RECOMMENDED ACTION
WATER MANAGEMENT:	
FLOOD PREVENTION (NED)	REDUCE FLOODING ON 30,000 ACRES TO PROVIDE THE TEN PERCENT LEVEL OF FLOOD PROTECTION
DRAINAGE IMPROVEMENT (NED)	IMPROVE DRAINAGE ON 500,000 ACRES TO REDUCE WATER TABLE, AND SOIL SALINITY, AND MAINTAIN FULL AGRICULTURAL PRODUCTION.
IRRIGATION IMPROVEMENT (NED)	PROVIDE IRRIGATION FOR AN ADDITIONAL 66,000 ACRES AND IMPROVE IRRIGATION EFFICIENCY ON 22,000 ACRES.
OTHER WATER MANAGEMENT (EQ)	PROVIDE WATER FOR 91,000 ACRES OF WATERFOWL HABITAT AND DEVELOP 3,000 ACRES OF FISH HABITAT.
LAND MANAGEMENT	
DEVELOPED CAMPSITES (NED)	DEVELOP 4,000 CAMPSITES TO INCREASE RECREATION OPPORTUNITY BY 2.9 MILLION RECREATION DAYS ANNUALLY.
TIMBER PRODUCTION (NED)	INTENSIFY TIMBER MANAGEMENT TO MAINTAIN PRODUCTION AT 80 MILLION CUBIC FEET ANNUALLY.
WILDERNESS PRESERVATION (EQ)	PRESERVE 2.9 MILLION ACRES OF WILDERNESS (1.4 MILLION ACRES OF NATIONAL PARK AND 1.5 MILLION ACRES OF NATIONAL FOREST)
RANGE FORAGE (NED)	APPLY 26 LAND TREATMENT MEASURES ON RANGELAND TO INCREASE FORAGE PRODUCTION BY 2.95 MILLION ANIMAL UNIT MONTHS.
EROSION AND SEDIMENTATION (EQ)	APPLY 26 LAND TREATMENT MEASURES ON RANGELAND TO REDUCE THE AREA AFFECTED BY MODERATE AND SEVERE EROSION BY 60 PERCENT, REDUCE SEDIMENT PRODUCTION BY 50 PERCENT.
DEER HABITAT (EQ)	INTENSIFY MANAGEMENT ON 1.6 MILLION ACRES TO OFFSET HABITAT LOSSES RESULTING FROM INTENSIVE AGRICULTURE AND URBANIZATION.
WILDFIRE REDUCTION (EQ)	INTENSIFY MANAGEMENT ON 10.4 MILLION ACRES TO REDUCE THE ANNUAL ACREAGE BURNED BY 9,300 ACRES.

Total public and private costs for implementing the plan would average $44.2 million per year.

(NED) Designates component of the national economic development objective.

(EQ) Designates component of the environmental quality objective.

chapter I introduction

san joaquin valley basin study

INTERCROPPING PRACTICES

chapter I introduction

san joaquin valley basin study

In 1969, the California Department of Water Resources requested the U. S. Department of Agriculture (USDA) to conduct a Type IV River Basin Study of the San Joaquin Valley Basin in accordance with section 6 of PL 83-566. A plan of work was prepared in 1973.

The objective of the San Joaquin Valley Basin Study was to formulate alternative plans that solve land and water resource problems identified at the outset of the study. Emphasis was placed on problems expected to persist over the next 10 to 20 years that could be solved by USDA programs. It was not the intent of this study to present a comprehensive inventory of all resources and the solution to all resource problems.

The study was conducted in accordance with the USDA guidelines for River Basin studies and the U. S. Water Resources Council's "Principles and Standards for Planning Water and Related Land Resources" (19, 21). The study developed three plans:

1. The National Economic Development (NED) Plan emphasizes increasing the value of goods and services and improving economic efficiency.
2. The Environmental Quality (EQ) Plan emphasizes enhancing the quality of the environment by management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and historical resources and ecological systems.
3. The River Basin Planning Staff's "Preferred Plan" represents the staff's view of a reasonable mix of components from the NED plan and the EQ plan.

The information in this report is presented differently than most reports—the Preferred Plan and the opportunities for its implementation are presented early in the report by way of Chapters II and III. The remaining chapters discuss the investigations and analyses and provide the basis for the recommendations.

This report is based in part on the following staff reports published as "mini-reports," maps and Watershed Investigation Reports:

A. Mini-Reports

1. Soil Group Areas
2. Land and Water Areas
3. Crop Yields and Suitability
4. Crop Prices, Averaged and Normalized
5. Applied Water Requirements
6. Agricultural Drainage Study—Kern County
7. Rangeland (Inventory)
8. Fish and Wildlife (Problems)
9. Fish and Wildlife Supplement (Solutions and Economics)

B. Maps (1:250,000)

1. Soil Group
2. Vegetation
3. Land Use
4. Land Ownership and Administration
5. Flood Prone Areas
6. Irrigation Problems
7. Drainage Problems (Present)
8. Drainage Problems (year 2000 without Project Action)

9. Sediment Yield Map
10. Irrigation Suitability Maps
11. Availability for Irrigation Development Map
12. Range Site Suitability
13. Range Site Availability for Development
14. Range Site Improvement Opportunities
15. Rare and Endangered Plants, Animals and Landscapes
16. National Wetlands Inventory
17. Watershed Investigations Location Map

C. Appendices

1. Economic Base Study
2. Forestry Summary Report

D. Watershed Investigation Reports (Published)

Camp 13
Dos Palos
Gustine
Panoche-Broadview
San Luis
Westley-Grayson
Panoche-Silver Creek
Frazier-Strathmore
Orange Cove
Tehachapi

This report is also based on the following unpublished staff reports:

1. Drainage Problems and Needs
2. Public Participation
3. Linear Programming Model

The study was conducted by the Soil Conservation Service, Forest Service, and Economic Research Service (USDA River Basin Planning Staff) in cooperation with the California Department of Water Resources.

During the study, a number of organizations and agencies provided assistance or information to the USDA staff:

Federal Agencies

Army Corps of Engineers
Bureau of Reclamation
Fish and Wildlife Service
National Park Service
Bureau of Land Management
Bureau of Indian Affairs

California State Agencies

Department of Water Resources
Department of Fish and Game
California Regional Water Quality Control Board — Central Valley Region
Office of Planning and Research
Department of Forestry
Department of Parks and Recreation
State Reclamation Board
University of California, Davis
Department of Water Science and Engineering
Cooperative Extension Service

Others

Kern County Water Agency
Numerous county and city agencies
Resource Conservation Districts
Irrigation and Water Districts
Councils of Government
Private industries and citizens

Public Participation

Opportunity for public participation was provided at several stages of the study:

- At the outset of the study, a series of three public meetings were held. These were conducted in November 1972 at Bakersfield, Fresno, and Los Banos. The meetings were announced in the media and 300 organizations and individuals were sent direct invitations. Over 100 people attended the meetings.
- For individual watershed investigations, special presentations were made to potential project sponsors. Local steering committees were formed to provide input during the development of ten Watershed Investigation Reports. Briefings were held at the request of local water agencies, Resource Conservation Districts and others.
- A newsletter with a questionnaire was sent to 300 organizations and individuals in December 1974; a total of 41 responses were received. The primary intent of the newsletter was to obtain public input on environmental quality concerns.
- In June 1977, the draft report was disseminated for review, comment, and additional public input. Newsletters including report summaries and response forms were used to encourage public participation. Six public meetings were held at Bakersfield, Fresno and Modesto. The meetings were announced in the media and by direct invitation to 700 organizations and individuals. Sixty-five people attended the meetings while 50 written responses to the draft report were received. The recommended plan was modified as a result of the public response received.
- Indirect, as well as direct methods, were used to obtain public input. Indirect methods used included analysis of written comments on environmental statements for ongoing programs, consultation with managers of ongoing programs in various public agencies and review of previous studies.

PUBLIC PARTICIPATION IN RESOURCE MANAGEMENT

chapter II preferred plan
san joaquin valley basin study

ORANGE GROVE: MULCHED (BACKGROUND)
AND UNMULCHED (FOREGROUND)

chapter II preferred plan

san joaquin valley basin study

The Preferred Plan represents the River Basin Planning Staff's recommendation. It is generally a mix of the National Economic Development (NED) and the Environmental Quality (EQ) Plans.

Plan components have been assembled into two major groups: *Water Management* and *Land Management*. The Water Management group includes components for flood prevention, drainage improvement, irrigation improvement, and other water management. Problems in each group are inter-related and, therefore, plans for their solution are treated as a group.

The Land Management group includes components for developed campsites, timber production, widerness preservation, range forage, deer habitat, and wildfire reduction (Table II-6).

water management

Flood Prevention, Drainage Improvement, Irrigation Improvement, Other Water Management.

The Preferred Plan for flood prevention, drainage improvement, irrigation improvement, and other water management involves 28 PL-566 projects (Chapter V).

Watershed Investigation Reports (WIR's) were prepared for ten of the 28 Early Action Projects. The Westley-Grayson, Gustine, Camp 13, Panoche-Broadview, San Luis, Dos Palos, Panoche-Silver Creek, Tehachapi, Frazier-Strathmore and Orange Cove project areas were studied in greater detail than the other 18. Public meetings were held and steering committees were selected, comprised primarily of project sponsors, i.e. Resource Conservation Districts, but also included city and county public works and flood control districts, water agencies, irrigation districts, water districts, etc. The Preferred Plan reflects the wishes of the steering committees.

Data from these WIR areas were expanded for the other 18 projects. The recommended plans for these 18 projects were developed by the River Basin Planning Staff in cooperation with the local SCS Field Office personnel.

TABLE II-1. WATER MANAGEMENT COMPONENTS OF PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

COMPONENTS	UNITS	PREFERRED PLAN QUANTITY
Flood Prevention		
Reservoirs—Flood Protection	No. - Ac. ft	9 - 7,130
—Sediment Storage	No. - Ac. ft	7 - 10,600
—Multipurpose	No. - Ac. ft	1 - 140
Channel Work	Miles	81
Pipeline	Miles	36
Acres - Flood Prone - 10 percent level	Acres	29,800
Drainage Improvement		
Outlet Pipeline	Miles	548
Channel Work	Miles	201
Evaporation Basin	No. - Acres	3 - 6,300
Acres of improved drainage	Acres	499,500
Irrigation Improvement		
Canal Lining	Miles	12.0
Channel Work	Miles	168
Pipeline	Miles	38.3
Regulating Reservoir	No. - Ac. ft	1 - 160
Diversion Dam	No.	1
Tailwater Return System	Acres	4,066,000
Multipurpose Reservoir	No. - Ac. ft	1 - 140
Acres - Irrigated and Improved	Acres	88,390
Other Water Management		
Waterfowl Habitat Enhancement	Acres	90,900
Fish Habitat	Acres	3,000

Early Action Projects are those projects which could be implemented during the next 10 to 20 years.

Future Potential Projects are those not economically feasible at this time. However, they could become economically feasible in the future, given a change in the economic conditions of the country, changes in technology, or changes in national energy or water policy.

Projects Suitable To Other Programs are those projects that could be best solved by other USDA programs.

Table II-1 summarizes the Water Management Preferred Plan. Tables II-2 and II-3 summarize the Preferred Plan Measures for each subbasin. Tables II-4 and II-5 summarize the beneficial and adverse effects of each of the 28 "Early Action Projects". The Preferred Plan is evaluated in terms of the four detailed accounts in Chapter X.

TABLE II-2. WATER MANAGEMENT COMPONENTS OF PREFERRED PLAN, SAN JOAQUIN SUBBASIN, SAN JOAQUIN VALLEY BASIN

PROJECT NUMBER	PROJECT	STRUCTURAL MEASURES	AREA BENEFITTED	PROJECT INSTALLATION COST[1]
2	Westley-Grayson (D)	37 miles of pipeline drainage collection system.	Reduce high water table and soil salinity on 18,400 acres.	$3,883,000
3	Patterson (D)	15.4 miles of pipeline drainage collection system. 1.6 miles channel work.	Reduce high water table and soil salinity on 4,190 acres.	$2,068,000
5	Newman (D)	10.5 miles of pipeline drainage collection system. 0.9 miles channel work.	Reduce high water table and soil salinity on 3,030 acres.	$ 755,000
6	Gustine (D)	50 miles of piepline drainage collection system. 46.2 miles of irrigation distribution channel in the wildlife area.	Reduce high water table and soil salinity on 55,100 acres. Provide irrigation for 28,600 acres of native pasture in the wildlife area.	$3,722,000
7	Camp 13 (D)	30.3 miles of pipeline drainage collection system. 13 miles of drainage channel work on the agricultural land. 49.3 miles of irrigation distribution channel work in the wildlife area.	Reduce high water table and soil salinity on 62,700 acres. Provide irrigation for 4,340 acres of native pasture in the wildlife area.	$2,861,000
8	Panoche-Broadview (D)	24 miles of drainage channel work on the agricultural land. 64 miles of irrigation distribution channel work in the wildlife area.	Reduce high water table and soil salinity on 63,000 acres. Provide irrigation for 18,500 acres of native pasture in the wildlife area.	$2,335,000
9	San Luis (D)	126 miles of drainage channel work on the agricultural land.	Reduce high water table and soil salinity on 78,800 acres. Provide irrigation for 1,800 acres of native pasture in the wildlife area.	$4,090,000
10	Dos Palos (D)	24 miles deep drainage channel work. 2.3 miles shallow drainage channel work. 8.4 miles of channel work in the wildlife area.	Reduce high water table and soil salinity on 13,300 acres. Provide irrigation for 5,700 acres of native pasture in the wildlife area.	$1,422,000
14	Dry-Schmidt Creek (F)	1,000 ac. ft. flood storage, 1 dam. 400 ac. ft. sediment storage. 12.3 miles channel work.	10% level of flood protection for 4,800 acres.	$1,727,000
15	El Nido (I)	4.8 miles concrete lined irrigation canal. 3 miles irrigation pipeline. Enlarge regulation reservoir from 40 to 200 ac. ft.	Provide a stable supply of surface irrigation water for 8,500 acres.	$1,871,000
18	Stevinson (D, I)	6.3 miles concrete lined irrigation canal. 15.5 miles irrigation pipeline. 44.5 miles of pipeline drainage collection system. 800 acres of evaporation ponds.	Provide an improved irrigation distribution system for 11,400 acres to minimize seepage losses and conserve water. Reduce high water table on 8,000 acres.	$4,561,000
21	Hopeton (D, I)	1.8 miles drainage channel work. 16.4 miles of pipeline drainage collection system. 0.9 miles concrete lined irrigation canal. 19.8 miles irrigation pipeline. 1 diversion dam.	Reduce high water table on 8,500 acres. Provide an improved irrigation distribution system for 8,500 acres to minimize seepage losses and conserve water.	$6,335,000

[1]Does not include project administration, associated and OM&R costs.

(F) Flood Prevention.
(D) Drainage.
(I) Irrigation.

TABLE II-3. WATER MANAGEMENT COMPONENTS OF PREFERRED PLAN, TULARE SUBBASIN, SAN JOAQUIN VALLEY BASIN

PROJECT NUMBER	PROJECT	STRUCTURAL MEASURES	AREA BENEFITTED	PROJECT INSTALLATION COST[1]
2	Panoche-Silver Creek (F)	2800 ac. ft. flood storage, 1 dam. 8,800 ac. ft. sediment storage. 5.8 miles channel work. 28 acre sediment basin.	Provide 10% level of flood protection on 9,700 acres. Reduce erosion on 9,700 acres.	$ 7,389,000
9	Buttonwillow North Drainage (D)	6914 miles of pipeline drainage collection system.	Reduce high water table and soil salinity on 45,800 acres.	$13,534,000
10	Buttonwillow (D)	6.5 miles of pipeline drainage collection system.	Reduce high water table and soil salinity on 4,300 acres.	$ 1,270,000
11	Buttonwillow South Drainage (D)	8.5 miles of pipeline drainage collection system.	Reduce high water table and soil salinity on 5,600 acres.	$ 1,654,000
12	Buena Vista Valley Drainage (D)	8.2 miles of pipeline drainage collection system.	Reduce high water table and soil salinity on 5,400 acres.	$ 1,595,000
13	Midway Valley Drainage (D)	21.5 miles of pipeline drainage collection system.	Reduce high water table and soil salinity on 14,200 acres.	$ 4,196,000
14	Kern Lake Drainage (D)	28.9 miles of pipeline drainage collection system.	Reduce high water table and soil salinity on 19,100 acres.	$ 5,645,000
17	Tehachapi (F)	1,080 ac. ft. flood storage, 2 dams. 420 ac. ft. sediment storage. 3 miles channel work 0.8 miles pipeline.	Provide 1% level of flood protection on 3,000 acres of agricultural land and 800 acres urban land.	$ 4,430,000
18	Caliente Creek (F)	8.1 miles channel work and dikes. 1 sediment retention basin. 1 existing 240 acre retention basin.	Provide 10% level of flood protection on 18,400 acres.	$ 2,220,000
19	Walker Basin Creek (F) (Planned in Conjunction with Caliente Creek)	*Land treatment* only Brush control — 14,000 acres. Fire control — 65,000 acres. Wildlife habitat development — 500 acres. Stockwater development — 60 acres. Proper range use — 43,000 acres.	Reduce erosion and fire hazard on 65,000 acres. Improve wildlife habitat on 14,000 acres.	(Included Above)
23	Terra Bella (F, D)	120 ac. ft. flood storage, 1 dam 20 ac. ft. drainage and irrigation storage. 220 ac. ft. sediment storage. 30 miles pipeline.	Provide 10% level flood protection on 400 acres. Reduce high water table on 2,000 acres. Provide irrigation water for 300 acres. Reduce erosion on 4,000 acres citrus land	$ 4,883 000
24	Frazier-Strathmore (F, D)	1,660 ac. ft. flood storage and 370 ac. ft. sediment storage, 1 dam and 2 regulating reservoirs. 7.2 miles concrete lined channel. 4.4 miles pipeline.	Provide 10% level flood protection on 805 acres and 1% level flood protection for the town of Strathmore. Reduce high water table on 2,800 acres. Reduce erosion on 8,900 acres.	$ 8,727,000
27	Lemoore (D)	100 miles pipeline drainage collection system. Evaporation basins on 3,300 acres.	Reduce high water table and soil salinity on 52,000 acres. Enhance food supply and provide nesting area for waterfowl on 3,300 acres.	$21,835,000
29	Lanare-Five Points (D)	66.9 miles pipeline drainage collection system. Evaporation ponds on 2,200 acres.	Reduce high water table and soil salinity on 33,000 acres. Enhance food supply and provide nesting area for waterfowl on 2,200 acres.	$13,983,000
33	Antelope-Woodlake (F)	9 miles channel work. 0.3 miles pipeline.	Provide 1% level flood protection to City of Woodlake and 10% level flood protection on 1,470 acres of agricultural land	$ 1,012,000
36	Orange-Cove (F)	470 ac. ft. flood storage, 1 dam. 405 ac. ft. sediment storage. 36 miles channel work. 3.9 miles floodways. 1.2 miles dike.	Provide 1% level of protection to rural towns and 10% level of protection for 21,000 acres of agricultural land. Reduce erosion on 18,000 acres.	$11,575,000

[1]Does not include project administration, associated and OM&R costs.

(F) Flood Prevention.
(D) Drainage
(I) Irrigation.

TABLE II-4. SUMMARY OF EFFECTS OF WATER MANAGEMENT COMPONENTS OF EARLY ACTION PROJECTS, PREFERRED PLAN NATIONAL ECONOMIC DEVELOPMENT ACCOUNT, SAN JOAQUIN SUBBASIN, SAN JOAQUIN VALLEY BASIN

COMPONENTS	MEASURES OF EFFECTS												
	Westley-Grayson	Patterson	Newman	Gustine	Camp 13	Panoche-Broadview	San Luis	Dos Palos	Dry Schmidt Creek	El Nido	Stevinson	Hopeton	Total
BENEFICIAL EFFECTS	(Thousands of Dollars Annually)												
The Value to Users of Increased outputs of Goods and Services:													
1. Flood Prevention	—	—	—	—	—	—	—	—	147	—	—	—	147
2. Drainage	1,591	652	186	1,606	782	794	1,661	205	—	—	125	793	8,395
3. Irrigation	—	—	—	290	77	280	40	64	—	251	610	170	1,782
4. Other Water Management	—	—	—	334	46	334	35	81	—	—	—	—	830
5. Utilization of Unemployed or Underemployed Labor Resources	179	11	7	39	19	25	33	8	2	4	11	14	352
Total Beneficial Effects	1,770	663	193	2,269	924	1,433	1,769	358	149	255	746	977	11,506
ADVERSE EFFECTS													
The Value of Resources Required for the Plan:													
1. Flood Prevention													
Project Installation	—	—	—	—	—	—	—	—	110	—	—	—	110
OM&R	—	—	—	—	—	—	—	—	25	—	—	—	25
Project Administration	—	—	—	—	—	—	—	—	10	—	—	—	10
2. Drainage													
Project Installation	248	132	48	202	142	61	261	83	—	—	95	343	1,615
OM&R	201	22	7	152	215	105	312	63	—	—	11	15	1,103
Project Administration	24	13	5	20	14	5	27	8	—	—	9	36	161
3. Irrigation													
Project Installation	—	—	—	18	21	44	—	4	—	119	215	62	483
OM&R	—	—	—	9	11	63	2	4	—	48	16	77	230
Project Administration	—	—	—	1	2	4	—	—	—	11	20	6	44
4. Other Water Management													
Project Installation	—	—	—	18	20	44	—	4	—	—	—	—	86
OM&R	—	—	—	9	11	62	3	17	—	—	—	—	102
Project Administration	—	—	—	1	2	4	—	—	—	—	—	—	7
5. Associated Costs													
Project Installation	332	60	58	914	327	496	259	84	—	—	277	260	3,067
OM&R	36	6	6	111	39	65	33	12	—	—	31	30	369
Total Adverse Effects	841	233	124	1,455	804	953	897	279	145	178	674	829	7,412
Net Beneficial Effects	929	430	69	814	120	480	872	79	4	77	72	148	4,094

[1]1975 prices, 6⅜% interest amortized over 100 years.

TABLE II-5. SUMMARY OF EFFECTS OF WATER MANAGEMENT COMPONENTS OF EARLY ACTION PROJECTS, PREFERRED PLAN NATIONAL ECONOMIC DEVELOPMENT ACCOUNT, TULARE SUBBASIN, SAN JOAQUIN VALLEY BASIN

COMPONENTS	MEASURES OF EFFECTS															
	Panoche Silver Creek	Buttonwillow North Drainage	Buttonwillow	Buttonwillow South	Buena Vista Valley Drainage	Midway Valley Drainage	Kern Lake Drainage	Tehachapi	Caliente Creek	Terra Bella	Frazier-Strathmore	Lemoore	Lanare-Five Points	Antelope Woodlake	Orange Cove	Total
BENEFICIAL EFFECTS								(Thousands of Dollars Annually)								
The Value to Users of Increased Outputs of Goods and Services:																
1. Flood Prevention	535	—	—	—	—	—	—	340	268	159	557	—	—	186	1,261	3,306
2. Drainage	—	5,291	497	647	624	1,640	2,941	—	—	630	3,026	6,008	3,847	—	—	25,151
3. Other Water Management	—	—	—	—	—	—	—	9	—	—	—	—	—	—	14	23
4. Utilization of Unemployed or Underemployed Labor Resources	18	77	7	9	9	24	43	12	3	10	10	88	56	—	16	382
Total Beneficial Effects	553	5,368	504	656	633	1,664	2,984	361	271	799	3,593	6,096	3,903	186	1,291	28,862
ADVERSE EFFECTS																
The Value of Resources required for the Plan:																
1. Flood Prevention																
Project Installation	472	—	—	—	—	—	—	283	142	113	373	—	—	65	739	2,187
OM&R	31	—	—	—	—	—	—	45	45	4	29	—	—	8	145	307
Project Administration	42	—	—	—	—	—	—	29	10	10	26	—	—	7	45	169
2. Drainage																
Project Installation	—	865														
OM&R	—	87	81	106	102	268	361	—	—	199	184	1,395	893	—	—	4,454
Project Administration	—	85	8	11	10	27	36	—	—	12	18	93	59	—	—	361
3. Associated Costs			8	10	10	26	36	—	—	20	16	106	69	—	—	386
Project Installation	—	1,571	148	192	185	466	655	—	—	43	58	1,020	685	—	—	5,023
OM&R	—	175	16	21	21	76	73	—	—	10	6	113	79	—	—	590
Total Adverse Effects	545	2,783	261	340	328	863	1,161	357	197	411	710	2,727	1,785	80	929	13,477
Net Beneficial Effects	8	2,585	243	316	305	801	1,823	4	74	388	2,883	3,369	2,118	106	362	15,385

[1]1975 Prices, 6⅜% interest amortized over 100 years.

land management

Developed Campsites

The River Basin Planning Staff estimates that development of an additional 4000 campsites by the year 2000 would require an investment of about $24 million for installation and $2.4 million per year for operation and maintenance. These campsites could satisfy the additional 2.9 million recreation visitor days of annual camping demand and would require only about 1000 acres of land.

About 50 percent of this could be supplied by the private sector, the other half by the public sector.

The development of this element of the Preferred Plan could potentially reduce environmental problems associated with camping in undeveloped areas. This plan element is included in both the NED and EQ Plans.

CAMPING IN THE STANISLAUS NATIONAL FOREST

Timber Production

Annual timber production would be maintained at 80 million cubic feet through the year 2000 in this plan. A decline in the timberland base is offset by increased timber management intensity. Management would be intensified to a greater degree on private lands than on public lands.

Maintaining annual timber production at 80 million cubic feet would require annual expenditures of about $10.5 million. This is an increase of about $500,000 over expenditures estimated for ongoing programs. Increased investment on privately owned timberland could be encouraged through expansion of the cooperative forest management and forestry incentives programs. Management intensity on National Forest would increase moderately under ongoing programs.

TABLE II-6. LAND MANAGEMENT COMPONENTS OF PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

COMPONENTS	RECOMMENDED ACTION	EFFECT
Developed Campsites	Develop 4000 additional campsites.	Increase recreation opportunity by 2.9 million recreation days.
Timber Production	Intensify timber management.	Maintain present levels of timber production
Wilderness Preservation	Preserve all lands having wilderness characteristics.	Preserves a total of 2.9 million acres of wilderness.
Range Forage	Apply 26 land treatment measures.	Increases forage production by 2.95 million animal unit months of grazing.
Erosion and Sedimentation	Apply land treatment measures on rangeland and establish streambelts.	Reduces soil erosion on rangeland and sediment pollution in streams.
Deer Habitat	Implement *California Deer Plan*.	Improves habitat quality on 1.6 million acres under intensive management.
Wildfire Reduction	Intensify fire management on 10,400,000 acres.	Reduces annual acreage burned by 9,300 acres.

TREE FALLING

A 25 percent increase in timber production was recommended earlier in the study. However, comments received during the review process indicated a general opposition to the management intensity that would be required. Public comments in particular indicate that greatly increased management intensity on National Forest would not be compatible with environmental quality goals. As a result, the level of timber management intensity recommended was reduced.

Wilderness Preservation

A total of 2.9 million acres of land having wilderness characteristics could be preserved in this plan. This could be accomplished either by expansion of the National Wilderness Preservation System or by administrative decisions to manage additional land for dispersed recreation. This plan withdraws an additional 60,000 acres of commercial forest land from the timberland base. However, because management intensity is increased, timber harvests would be maintained at 80 million cubic feet annually.

Range Forage—All Lands

Range forage production is increased by 2.95 million animal unit months per year in the Preferred Plan.

The Preferred Plan excludes livestock from 13,900 acres and also provides wildlife watering facilities and quail roosts. Average annual costs are $6.9 million for the plan. Table V-3 shows the extent of the rangeland problems.

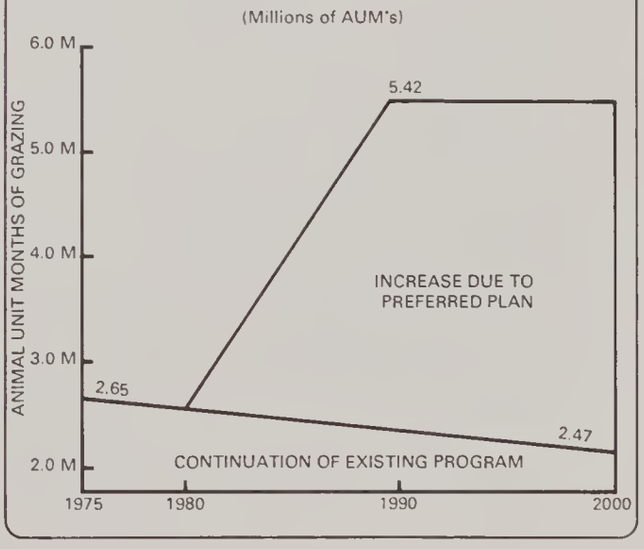
Range Forage—Privately Owned Lands

Productivity of privately owned rangelands in the Basin can be dramatically improved with the application of land treatment measures and accelerated levels of technical assistance. There are seven problems occupying 3,330,000 acres.

Assuming the land treatment measures would be installed over the ten-year period from 1980 to 1990, annual productivity is projected to reach 5,018,000 animal unit months of grazing from 1990 into the future. This represents an annual gain of 2,785,000 animal unit months of grazing over the projected production in the year 2000 if present trends and levels of technical assistance continue (Figure II-1).

The resulting increase in livestock gain is an estimated 134,093,000 pounds, worth approximately $40,228,000 in 1975 dollars of gross income.

FIGURE II-1. RANGE FORAGE PRODUCTIVITY CHANGES, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN



Wildlife benefits are provided by excluding 7,200 acres from grazing to protect critical habitat of endangered species. Also, 270,000 animal unit months of grazing for deer are provided, and 570 wildlife watering facilities and 1,150 artificial quail roosts are proposed.

Critical area plantings on 6,700 acres would also be excluded from grazing. These areas could offer limited habitat for wildlife. Recreation area improvements on 200 acres are also included. Reduced erosion and sedimentation damage would result.

Average annual cost of the land treatment measures is estimated at $6,784,000 for the Basin. Accelerated technical assistance for the 10-year application period would add another $156,000 to the average annual cost.

Average annual benefits from increased forage production, wildlife improvements, and recreation improvements are estimated at $9,650,000.

The amounts of land treatment proposed are shown on Table II-7.

For the purpose of this study, seven rangeland problems affecting 3,330,000 acres are described. The Preferred Plan recommendations vary for each problem.

Problem 1. Forage production adequate. Desired vegetation present. *Plant cover poor at end of season.* 1,341,000 acres.

Proper grazing management is needed to insure adequate plant cover at the end of the grazing season and to maintain desired vegetation. In order to achieve a high level of management efficiency, the following additional measures are needed. Cross-fencing and salting are needed to achieve more uniform grazing. Stock trails are needed to provide access to undergrazed areas. Water development is an essential part of getting more uniform grazing.

TABLE II-7. RANGE FORAGE COMPONENT OF PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

SOLUTIONS BY RESOURCE MANAGEMENT SUBSYSTEMS	UNITS	PRIVATE LANDS	NATIONAL FOREST LANDS	BASIN TOTAL
RANGE MANAGEMENT SUBSYSTEM				
ACCESS ROADS	FT.	1,245,200	105,600	1,350,800
BRUSH MANAGEMENT	AC.	223,300	30,000	253,300
DEFERRED GRAZING	AC.	1,179,600	—	1,179,600
FENCING	FT.	10,091,900	15,840,000	25,931,900
FERTILIZING	AC.	900,400	15,000	915,400
PROPER GRAZING USE	AC.	3,316,300	599,000	3,915,300
RANGE SEEDING	AC.	179,900	5,800	185,700
SALTING	APPLIC.	3,800	—	3,800
STOCK TRAILS	FT.	2,273,800	—	2,273,800
WATERING DEVELOPMENT SUBSYSTEM		200 *a*	200 *a*	
PIPELINE	FT.	3,882,600	—	3,882,600
POND	NO.	1,090	—	1,090
SPRING DEVELOPMENT	NO.	340	—	340
TROUGH OR TANK	NO.	1,960	—	1,960
WELL	NO.	90	—	90
WILDLIFE WATERING FACILITY	NO.	570	—	570
WILDLIFE MANAGEMENT SUBSYSTEM				
BRUSH MANAGEMENT	AC.	10,200	—	10,200
LIVESTOCK EXCLUSION	AC.	7,200	—	7,200
RANGE SEEDING	AC.	221,100	—	221,100
WILDLIFE UPLAND HABITAT MANAGEMENT	AC.	371,100	—	371,100
RECREATION MANAGEMENT SUBSYSTEM				
ACCESS ROADS	FT.	2,248,700	—	2,248,700
RECREATION AREA IMPROVEMENT	AC.	200	—	200
RECREATION TRAILS AND WALKWAYS	FT.	8,658,400	—	8,658,400
EROSION CONTROL SUBSYSTEM				
CRITICAL AREA PLANTING	AC.	6,700	—	6,700
LIVESTOCK EXCLUSION	AC.	6,900	—	6,900
FERTILIZING	AC.	6,700	—	6,700
FIREBREAK	FT.	8,594,800	—	8,594,800

a Water Development Subsystems not itemized.

OVERGRAZED PASTURE

PROPERLY MAINTAINED PASTURE

Ponds with an average capacity of four-acre feet are needed. Springs are needed to supplement ponds and wells are needed to complete the water supply. Troughs or tanks at each development can maintain daily water supplies. Piplines connect the troughs and tanks to the water supplies.

Application of these measures is expected to increase forage production to 100 percent of its natural potential. This represents a gain of 25 percent. Productivity is expected to improve from 71 percent at present to 75 percent by the year 2000 without any new programs, due to improved management by owners and operators.

Problem 2. Forage production low. Desired vegetation present but grows poorly. *Low soil fertility*. Plant cover poor at end of season. 538,000 acres.

All of the measures described for Problem 1 are needed plus fertilizing with nitrogen every other year to overcome low soil fertility and overgrazing. Fertilizer is proposed where soil depth is at least 20 inches, precipitation is 12 inches or more and available water holding capacity of the soil is 3 inches or more.

These measures are expected to increase forage productivity to 100 percent of its improved potential which is two to three times greater than its natural potential. There are 170,000 acres unsuitable for fertilizing and their productivity is expected to increase from 45 percent at present to 70 percent of natural potential.

Problem 3. Forage production low. Desired vegetation present but grows poorly. Low soil fertility. *Encroachment by woody and noxious plants*. 257,000 Acres.

All of the treatments described for Problem 2 are needed plus brush management by ground application of chemical sprays every three years to control the invasion by undesirable plants. Brush management is proposed where soil depth is at least 20 inches or more and precipitation is 16 inches or more.

These measures are expected to increase forage production to 100 percent of improved potential. There are 136,000 acres unsuitable for brush management or fertilizing and their productivity is expected to increase from 30 percent at present to 50 percent of natural potential.

Problem 4. Forage production low. *Low population of desired vegetation*. Low soil fertility. 112,000 Acres.

All the treatments described for Problem 2 are needed plus access roads, deferred grazing, and range seeding to re-establish a high population of desirable plants and increase soil fertility. Ten foot wide access roads are needed to allow wheeled vehicles to transport feeds and livestock to individual fields. Deferred grazing applies to the newly seeded areas to insure adequate seed production to perpetuate desirable plants. Range seeding is needed on the same lands suitable for fertilizing. Lana vetch and Blando brome or Sub-

PROPER SEEDING TRANSFORMED A PATCH OF ALKALI INTO PRODUCTIVE PASTURE

clover and Perla koleagrass are the species considered for planting.

These measures are expected to increase forage production to 100 percent of improved potential. There are 34,000 acres unsuitable for range seeding and fertilizing and their productivity is expected to increase from 15 percent at present to 50 percent of natural potential.

Problem 5. Forage production very low. *Woody and noxious plants have largely replaced desired vegetation*. Low soil fertility. 190,000 Acres.

All the treatments described for Problem 4 are needed plus brush management to convert these brush areas to productive range. Treatment involves knocking down the brush in the fall and burning it the following spring, or using a mechanical brush chopper or shredder. Aerial application of chemical sprays would follow two years after burning, with spot application of sprays by ground application every three years thereafter.

These measures are expected to increase forage production to 100 percent of improved potential. There are 88,000 acres unsuitable for brush management and their productivity is expected to increase from 10 percent at present to 50 percent of natural potential.

Problem 6. *Loss of wildlife habitat*. 371,000 Acres.

Wildlife upland habitat management is needed on all of this area. Approximately half of the forage would be grazed by wildlife and the rest by livestock so proper grazing use is also needed on all lands except 7,200 acres excluded from livestock grazing.

Exclusion areas are to protect habitat for the rare blunt-nosed leopard lizard and endangered limestone salamander, Tehachapi slender salamander, and San Joaquin kit fox (5). The grazing development rights on these 7,200 acres could be sold to the State of California and managed by the Department of Fish & Game. Fencing is needed to exclude these areas and to reduce the size of fields. Brush management is needed on 20,000 acres. Only half of the brush area would be converted to food plantings for upland game.

RIO GRANDE TURKEYS IN WINTER RANGE

This would retain escape cover and would greatly increase the "edge effect." Areas where brush is controlled would be seeded to reestablish a high population of desirable grazing plants—primarily Lana vetch.

Phosphate fertilizer is to be applied to all of the seeded areas. Deferred grazing will be needed on all except excluded areas to allow wildlife prime grazing and provide an adequate seed crop.

Proposed wildlife watering facilities include 500 gallon "quail guzzlers." Part of the wildlife upland habitat management treatment would be the construction of two artificial quail roosts within a half mile of each quail guzzler. Wildlife

ELEVATED BRUSH PILES FOR QUAIL

would also benefit from ponds, springs, wells and related troughs, tanks, and pipelines as described in the solutions given for Problem 1.

Application of these measures is expected to increase forage production to 100 percent of its improved potential. There would be 10,000 acres of untreated brush which would continue to deteriorate from 37 percent at present to 15 percent of natural potential. There are 138,000 acres unsuitable for seeding and fertilizing where productivity is expected to improve from 37 percent at present to 70 percent of natural potential because of improved management.

Problem 7. *Recreation overuse.* 521,000 Acres.

These areas appeal to recreation users due to their proximity to transportation routes and closeness to urban centers.

Critical area planting is needed on 2 percent of this area to correct erosion problems. Blando brome would be planted and protected with straw mulch. Nitrogen fertilizer would be applied at seeding and every fourth year thereafter. Livestock exclusion and fencing would be needed on these areas so the vegetative cover can have time to heal the erosion.

Recreation area improvements are needed to provide substitute areas for recreation users. These improvements would consist of pruning existing vegetation to make it suitable for picnicking and fencing to exclude livestock. Access roads 16 feet wide are needed to control recreation vehicle travel. Recreation trails and walkways are also needed to provide hikers and off road vehicle users access to the area.

Proper grazing use is needed on all the nonexcluded areas to insure adequate vegetative cover at the end of the season. Deferred grazing is needed to schedule livestock use with recreation use periods. Since these areas will be subject to heavy human use, 12 foot firebreaks are needed to reduce fire burn areas.

These measures are expected to increase forage production to 85 percent of natural potential. This would be a 35 percent gain from the present.

Erosion and Sedimentation

Sheet and gully erosion in the foothills will be greatly reduced by the proposed rangeland program. The area affected by moderate to severe erosion would be reduced by 60 percent. The value of this improvement is reflected in improved forage production. The amount of eroded material reaching live streams will be reduced from 25 percent at present to an average of 10 percent by the year 1990.

Another source of sediment will continue to be streambank erosion. Improved vegetative cover as part of the proposed range program will reduce the rate of streambank erosion by reducing the peak flows in streams. Construction of over 1,000 ponds will also reduce peak flows. Streambank erosion is expected to decrease from the present rate of destroying approximately 170 acres annually to a loss of only 110 acres.

STREAMBANK EROSION

Construction of streambank protection was found to be infeasible. Purchase of development rights to the stream channels plus a 50 foot wide corridor along each side of the stream is a proposed measure. Fencing this area to exclude livestock grazing would provide maximum vegetative protection to streambanks. The average annual cost of this measure is estimated at $450,000 to buy development rights to streambelts with an average width of 150 feet and to fence them.

Deer Habitat

Intensive deer habitat management of 1.6 million acres is included in the Preferred Plan. Measures include site scarification, brush piling or crushing followed by burning, prescribed burning, and herbicide spraying of brush. These measures would increase the deer population, reduce the wildfire threat, and also increase forage production for livestock. Habitat improvement investments of $56 million over a 25 year period followed by restoration and maintenance expenditures of $2.8 million annually would be required.

Wildfire Reduction

The average annual acreage burned by wildfire is reduced by 9300 acres in the Preferred Plan. Measures include increased investment in fire protection equipment, fuel management and fire protection and suppression. On an annual basis, fire management costs would increase by $4.9 million. These costs are in addition to average annual costs of $21.3 million expected under ongoing programs by the year 2000. This plan element also reduces timber and range forage losses, reduces wildfire suppression and watershed restoration costs, improves wildlife habitat, and reduces fire-caused erosion and sedimentation.

LOCATION OF WATERSHED INVESTIGATIONS

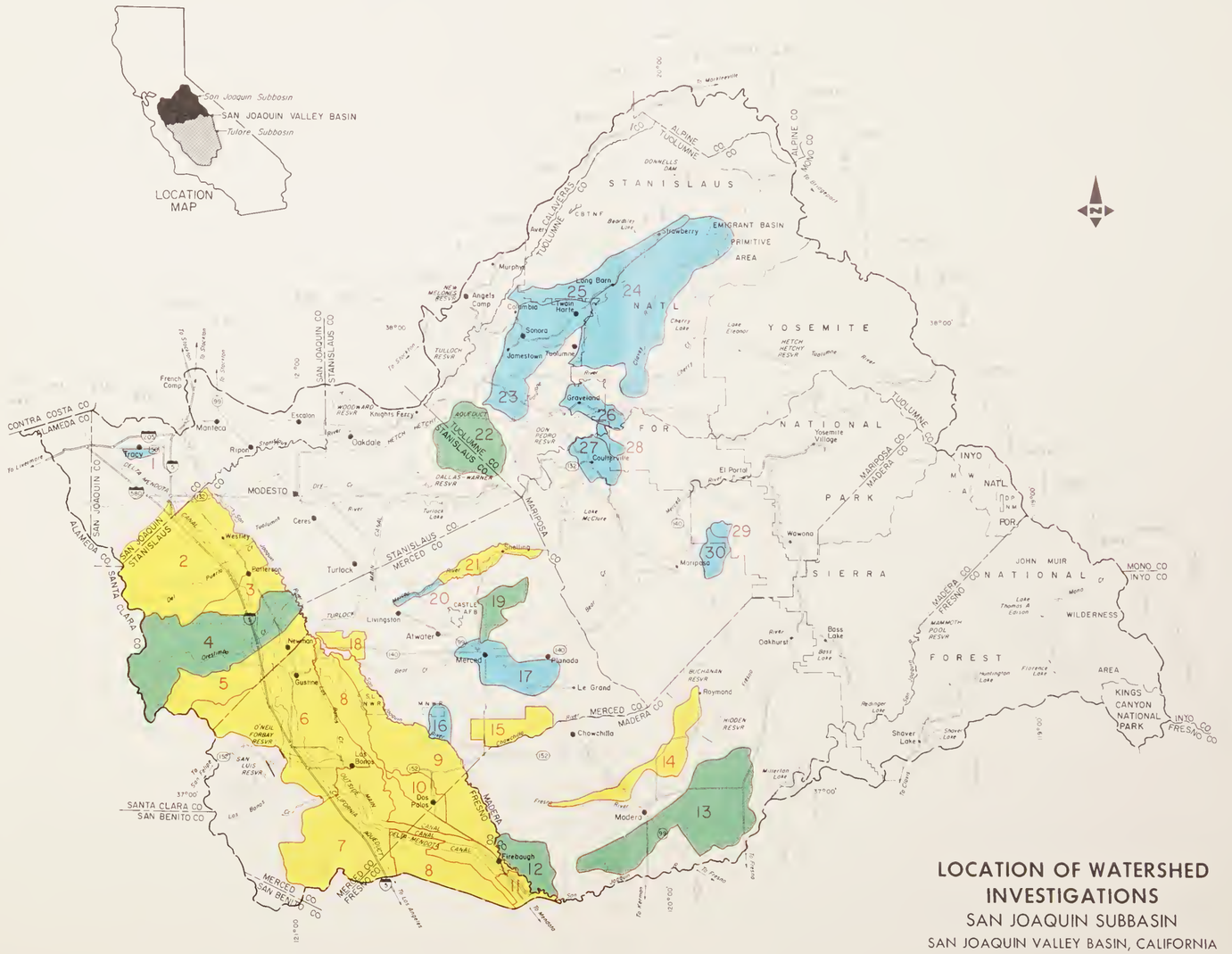
Project No.	Name	Acres
1	Tracy South Drainage	21,000
2	Westley-Grayson	182,700
3	Patterson	22,400
4	Orestimba Creek	126,800
5	Newman	82,900
6	Gustine	179,900
7	Camp 13	168,500
8	Panoche-Broadview	191,000
9	San Luis	118,900
10	Dos Palos	20,800
11	Panoche-Silver Creek	230,600
12	Lone Willow Slough	21,200
13	Cottonwood-Root Creek	158,000
14	Dry-Schmidt Creek	56,600
15	El Nido	10,000
16	Turner Island	11,300
17	Merced Drainage	45,100
18	Stevinson	12,600
19	Abatement-Industrial	31,000
20	Lower Merced River	2,300
21	Hopeton	12,500
22	Dry Creek	53,300
23	Sonora B	51,400
24	Tuolumne River	147,600
25	Sonora A	63,400
26	Groveland	31,300
27	Maxwell Creek	25,700
28	Bean Creek	4,500
29	Skelton Creek	2,700
30	Snow Creek	12,500

Early Action Project

Future Potential Projects

Suited to other USDA programs or other agency programs

= 50,000 ACRES



LOCATION OF WATERSHED INVESTIGATIONS

SAN JOAQUIN SUBBASIN

SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES

SCALE 1:1,140,000

10 0 10 20 30 KILOMETERS

Source:
Base map prepared by SCS, Portland Carto Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS PORTLAND OR-1976

M7-SN-23488-13

LOCATION OF WATERSHED INVESTIGATIONS

Project No.	Name	Acres
1	Panoche-Broadview	191,000
2	Panoche-Silver Creek	230,600
3	Pasajero Creek	56,300
4	Los Gatos Creek	87,700
5	Warthan Creek	91,900
6	Jacalitos Creek	49,200
7	Zapato Creek	70,200
8	Westlands Water District	212,300
9	Buttonwillow North Drainage	45,800
10	Buttonwillow	4,300
11	Buttonwillow South	5,600
12	Buena Vista Valley Drainage	5,400
13	Midway Valley Drainage	14,200
14	Kern Lake Drainage	20,400
15	Southern Stream Group	519,700
16	Sycamore Creek	23,400
17	Tehachapi	32,400
18	Caliente Creek	210,600
19	Walker Basin Creek	76,700
20	Poso Creek	206,700
21	White River	128,000
22	Deer Creek	161,300
23	Terra Bella	12,400
24	Frazier-Strathmore	21,100
25	Lewis Creek	20,500
26	Tulare Lake Drainage	153,300
27	Lemoore	77,500
28	Riverdale	14,900
29	Lanare-Five Points	33,300
30	Liberty Reed	30,000
31	Yokohl Creek	61,700
32	Ivanhoe	13,400
33	Antelope-Woodlake	14,000
34	Dry Creek	51,500
35	Cottonwood Creek	58,200
36	Orange Cove	159,900
37	Sierra (Clovis Area)	27,500

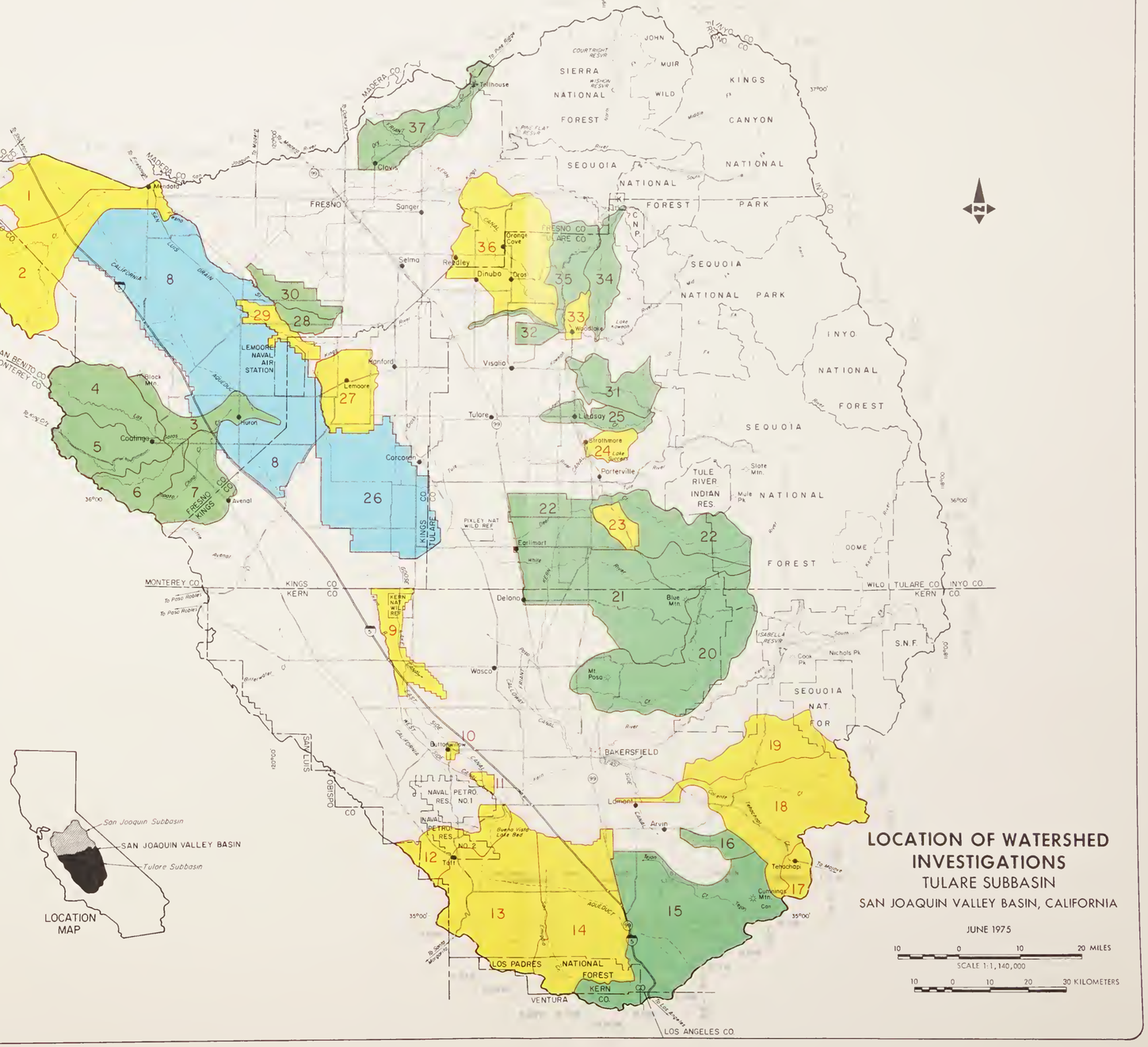
Early Action Project

Future Potential Projects

Suited to other USDA programs or other agency programs

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carto Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.



LOCATION OF WATERSHED INVESTIGATIONS
TULARE SUBBASIN
SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

M7-SN-23490-12

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA SCS PORTLAND OR 1976

chapter III opportunities for implementing the preferred plan and environmental impacts

san joaquin valley basin study

DOUGLAS FIR (MINE TIMBERS IN FOREGROUND)

chapter III opportunities for implementing the preferred plan and environmental impacts

san joaquin valley basin study

OPPORTUNITIES FOR USDA PROGRAMS

Public Law-46

The existing Conservation Operations program of the Soil Conservation Service provides technical assistance to cooperators in Resource Conservation Districts. Most of the rangeland is in Districts except western Fresno County, western Kings County, western Kern County, and a portion of eastern Tulare County.

Approximately 20 percent of the land treatment measures can be installed under the current Conservation Operations program. An estimated 20 percent of the measures are expected to be installed without technical assistance due to the "ripple effect" of talking to and seeing neighbors install land treatment measures.

Accelerated technical assistance totaling 84 man-years would be needed to install the remaining 60 percent of the measures during the 1980-1990 period.

This amount of accelerated technical assistance could be authorized upon approval of a special request for augmentation of the Conservation Operations Budget.

Watershed Protection and Flood Prevention Projects (Public Law-566)

Watershed projects cannot exceed 250,000 acres, so a large number of projects would be required with their own work plans. Each work plan would be processed separately through the approval and funding procedures.

The 28 "Early Action" projects are all potential PL-566 projects which could be authorized to install the structural and land treatment measures for flood prevention, drainage improvement, or irrigation improvement components.

Where rangeland is part of a proposed Small Watershed and Flood Prevention Project, accelerated technical assistance can be incorporated in the work plan for that project. These projects can also be authorized when the only measures will be land treatments where benefits can also be shown off-site such as sediment reduction.

Resource Conservation and Development Areas

The 212,360 acres of eastern San Benito County are in the Central Coast Resource Conservation and Development Area. There are no other Resource Conservation and Development (RC&D) Areas in the Basin and none are proposed. An RC&D Area would provide funding for critical area treatment identified in a work plan developed after receiving authorization for planning. Federal cost sharing could range from 50 to 80 percent and accelerated technical assistance could be included in the work plan.

Measures eligible for RC&D financial assistance would be (1) areas that are critically eroding, (2) areas where untreated erosion would adversely affect the community or general public, and (3) treated areas that would be kept under protective cover. This encompasses 6,700 acres in the Basin.

INADEQUATE LIVESTOCK WATER

Farmers Home Administration Loans

Soil and Water Conservation Loans are available to qualified landowners and operators from the Farmers Home Administration to finance capital investments for land treatment measures. These can be extended up to 40 years and repaid with 5 percent interest. Most of the land treatment measures except annual operating measures such as salting would be eligible.

Agricultural Conservation Program

The Agricultural Conservation Program (ACP) is administered by the Agricultural Stabilization and Conservation Service (ASCS) through county committees. This cost-sharing program provides incentives for landowners to carry out soil and water conservation practices where benefits are deferred or provide significant off-site benefits.

Each county committee establishes its program selecting from a list of national practices approved for California. This means that adjacent counties often do not offer cost-sharing on the same problems.

Two ACP practices offer up to 75 percent cost sharing for timber production measures. RE-3 is for tree planting and RE-4 is for stand improvement. The maximum payment is $2,500 per person per year.

Four ACP practices offer up to 70 percent cost-sharing for land treatment measures on rangeland up to the maximum of $2,500 per person per year. RE-2 is for improving permanent vegetative cover and includes range seeding, fertilizing, fencing, brush management, firebreaks, and critical area planting. RE-5 is for water impoundment reservoirs and includes ponds, pipeline, and troughs. SB-5 is for developing facilities for livestock water and includes wells, spring development, pipeline, troughs, and tanks. SB-11 is for constructing stock trails.

Three ACP practices offer 50 percent cost-sharing for land treatment measures for water management up to the maximum of $2,500 per person per year. RE-14 is for reorganizing irrigation systems and includes installation of pipelines; construction and/or lining irrigation ditches; constructing, enlarging or sealing of irrigation reservoirs; tailwater recovery systems and land leveling. SC-9 is for constructing open drainage ditches to dispose of excess water. SC-10 is for installing underground drainage systems and includes installing subsurface drainage pipelines to dispose of excess water.

The $2,500 maximum cost-sharing established by Congress has a limiting influence on the amount of work a participant will perform that year. The year to year variability of the county program and the uncertainty of the ACP budget from year to year also influence participants. Long Term Agreements were designed to overcome these limitations but few new agreements are being developed because the total cost of the Long Term Agreement must be budgeted from the current ACP funding allocation.

A coordinated effort is needed to develop annual programs in all the affected counties to include all nine practices.

WATER CONTROL STRUCTURES REDUCE VELOCITY IN LINED DITCH

TIMBER STAND IMPROVEMENT (THINNING) ON A MIXED CONIFER FOREST

Cooperative State and Federal Forestry Programs

The Cooperative Forest Management program can provide increased technical assistance to private forest landowners for campsite development and intensified timber management. It can also be used to provide technical assistance with intensive vegetation management for range forage production, deer habitat improvement and wildfire reduction.

The California Department of Forestry sells forest trees to private landowners and provides information on planting and care.

If the Forestry Incentive Program was expanded to include counties in the San Joaquin Valley Basin, financial incentives for intensified timber management could be provided to private forest landowners.

The Cooperative Fire Protection, Rural Community Fire Protection, Cooperative Forest Fire Prevention, and Federal Excess Property programs can be used to provide intensified fire management for State and private forest lands.

National Forest Management Programs

The Forest Service is responsible for managing National Forest for multiple use and sustained yield as required by the Multiple Use-Sustained Yield Act of 1960 and the National Forest Management Act of 1976. Campsite development, intensified timber management, wilderness preservation, range management, wildlife habitat improvement, and intensified fire management on National Forest can be achieved with existing management programs.

COORDINATION AND PROGRAMS FOR FURTHER DEVELOPMENT

Other Programs to Implement the Plan

Federal Programs

Section 208 of the Clean Water Act (PL 92-500) calls for identification and control of non-point sources of pollution. This program is being coordinated by the State Water Resources Control Board. Water quality plans will specify best management practices (BMPs) to control sediment pollution. It is expected these will include the same land treatment measures for rangeland found in the Preferred Plan aimed at sediment reduction.

State Programs

The proposed purchase of grazing development rights on the 7,200 acres of critical habitat for rare and endangered species and development rights to 800 miles of streambelts will require special funding and authorization for the California Department of Fish and Game.

BARK BEETLE DAMAGE

Resource Conservation Districts (RCD's)

These cover most of the rangeland except for western Fresno County, western Kings County, western Kern County, and part of eastern Tulare County. RCD's can incorporate technical assistance for planning land treatment on rangeland as a high priority item in their annual plans. Districts that span irrigated cropland and rangeland have had a tendency to emphasize assistance to the irrigated lands.

Projects Which Should be Planned Jointly or Need Further Coordination with Other Agencies

Land Exchange Program

This is needed to acquire critical wildlife habitat and needs to be coordinated with the purchase of grazing development rights. A joint study is needed to identify in detail 7,200 acres of critical habitat for the Limestone salamander, Tehachapi slender salamander, and San Joaquin kit fox. The California Department of Fish and Game, U. S. Fish and Wildlife Service, Bureau of Land Management, Forest Service, and Soil Conservation Service need to participate in the study.

Coordinated Planning

Coordinated planning is used to assist landowners who lease or own grazing lands adjacent to Federal land. Agencies and ranchers get together to formulate a management plan.

New Programs or Criteria to Meet Needs

Congressional action is needed for a long term cost sharing program for rangeland improvement measures.

Congressional action is needed for separate funding of annual ACP agreements and Long Term Agreements administered by the Agricultural Stabilization and Conservation Service.

Congressional action is needed to provide grants to the State of California to purchase "grazing development rights" on up to 7,200 acres to protect critical habitat of rare and endangered species and to purchase "development rights" to 800 miles of streambelts to reduce sedimentation.

State legislative action is needed to allow the Department of Fish and Game to purchase "grazing development rights" on up to 7,200 acres and "development rights" to 800 miles of streambelts.

ENVIRONMENTAL IMPACTS OF PREFERRED PLAN

Although this report is not an implementation document, the main environmental considerations are being presented as if the Preferred Plan were to be implemented. More complete environmental assessments will be made for individual parts of the Preferred Plan before they are implemented and environmental impact statements prepared as required.

This section presents the environmental impacts, favorable environmental impacts, adverse environmental effects, alternatives, short-term vs. long-term use of resources, and irreversible and irretrievable commitments of resources.

1. ENVIRONMENTAL IMPACTS

FLOOD PREVENTION MEASURES

Creates nine flood control reservoirs on 3,000 acres of irrigated cropland and pastureland.

Provides flood protection for 29,800 acres of irrigated cropland from 10 percent storm events.

Provides flood protection for the communities of Cutler, Orange Cove, Orosi, East Orosi, Strathmore, Woodlake and part of Tehachapi from 1 percent storm events.

Provides flood protection for the communities of Mendota, Dinuba, Arvin and Lamont from 10 percent storm events.

Reduces sedimentation downstream of the flood control reservoirs due to the 10,600 acres feet of sediment storage capacity in nine flood control reservoirs.

Converts 3,000 acres of the 4,684,200 acres of irrigated cropland and pastureland to flood control structures.

Creates 36 miles of buried pipelines and improves 81 miles of stream channels for flood control.

Vegetation in 81 miles of stream channels will be disturbed during channel modification work and is expected to become re-established within five years.

Creates 3,300 low to medium income jobs for Basin residents in conjunction with drainage and irrigation measures.

DRAINAGE IMPROVEMENT MEASURES

Creates 548 miles of buried drainage pipelines on 500,000 acres of irrigated cropland plus 201 miles of open drainage channels and 6,300 acres of evaporation basins.

Improves water table and salinity control on 500,000 acres of irrigated cropland to maintain productivity.

Decreases salts added to irrigated cropland soils by 501,000 tons annually.

Increases salts added to 91,000 acres of wildlife land by 240,000 tons annually.

Adds 261,000 tons of salt annually to the San Joaquin River during the high flow months of February, March and April.

Converts 7,300 acres of the 4,684,200 acres of cropland and pastureland to 201 miles of open drainage channels and 6,300 acres of evaporation basins.

IRRIGATION IMPROVEMENT MEASURES

Creates 38 miles of buried irrigation distribution pipelines and 12 miles of concrete lined irrigation canals on 88,390 acres of irrigated cropland and pastureland.

Enlarges storage capacity of an existing irrigation regulating reservoir by 160 acre feet and adds one diversion dam for irrigation water supply.

Provides water to irrigate an additional 66,000 acres of cropland and pastureland.

Converts 12 miles of unlined irrigation canals to concrete lined canals.

Destroys wildlife habitat on 12 miles of irrigation canals.

Improves upland game habitat on 66,000 acres of cropland and pastureland.

OTHER WATER MANAGEMENT MEASURES

Creates 168 miles of unlined irrigation distribution canals on 91,000 acres of wildlife land.

Enhances food supply and nesting cover for migratory waterfowl on 91,000 acres.

Provides an additional 39,700 acres of waterfowl ponds during the period September through March.

Provides 3,000 surface acres of water for fish habitat.

Increases Type 1 wetlands by 12,700 acres, Types 2 and 3 wetlands by 30,800 acres and Types 4 and 5 wetlands by 2,300 acres.

DEVELOPED CAMPSITES MEASURES

Develops 4,000 campsites on 1,000 acres of forest land.

Provides additional 2.9 million recreation visitor days at campsites.

TIMBER PRODUCTION MEASURES

Increases management intensity on 620,000 acres of timberland.

Increases frequency of harvest on 620,000 acres of timberland.

Increases noise, dust, erosion and sedimentation from 620,000 acres of timberland.

Maintains present levels of timber production.

WILDERNESS PRESERVATION MEASURES

Preserves 2,900,000 acres of wilderness including 1.4 million acres of the 1.6 million acres in National Parks and 1.5 million acres of the 3.6 million acres in National Forests.

Converts 60,000 acres of the 1.7 million acres of commercial timber to wilderness.

Requires increased timber management intensity on 620,000 acres in order to maintain present production levels.

RANGE FORAGE MEASURES

Creates 1,090 ponds on rangeland with a total surface area of 1,090 acres.

Provides potential for warm water fisheries in 500 ponds on rangeland with a surface area of 500 acres.

Provides additional 10,000 recreation visitor days of fishing.

Eliminates forage production of 500 animal unit months for livestock from 1,090 acres of the 5 million acres of rangeland converted to ponds.

Ground application of herbicides will be used to treat 121,000 acres of the 257,000 acres of light brush encroachment on rangelands.

Burning or chopping followed by aerial and ground application of herbicides will be used to treat 142,500 acres of the 378,500 acres of heavy brush encroachment on rangelands.

Converts 263,500 acres of the 635,500 acres of brush on rangeland to grasses and legumes.

Increases water yield from the 263,500 acres of rangeland converted from brush to grasses and legumes.

Increase in erosion and sedimentation from 263,500 acres of rangeland during first year of brush management program.

Nitrogen and/or phosphate fertilizers will be applied to 457,500 acres of rangeland annually.

Improved grasses and legumes will be seeded on 407,000 acres of rangeland.

Reserves 7,200 acres of rangeland to wildlife habitat for rare and endangered species.

Forage production of 3,600 animal unit months from 7,200 acres of rangeland converted to wildlife habitat will not be available for livestock.

Provides an additional 2.95 million animal unit months of grazing for livestock on 3.4 million acres of rangeland resulting in an additional 134 million pounds of livestock gain on rangeland annually after 1990.

Quail populations will be increased by the addition of 570 watering facilities and 1,150 artificial roosts.

Provides additional 2,300 recreation visitor days of quail hunting.

Creates 1,777 medium income jobs for Basin residents in conjunction with other land treatment measures.

EROSION AND SEDIMENTATION MEASURES

Bank erosion along 800 miles of streams primarily on rangeland will be reduced from 170 acres to 110 acres annually.

Streambelts along 800 miles of streams that include the stream channel plus 50 feet along each side protected from grazing will improve 14,500 acres of habitat for upland game and maintain riparian habitat.

Streambelts along 800 miles of streams will reduce amounts of sediment from sheet and

rill erosion from adjacent fields reaching streams.

Forage production of 9,700 animal unit months from 14,500 acres of rangeland converted to streambelts will not be available for livestock.

Sedimentation from 6,700 acres of critically eroding rangeland will be reduced by re-establishing vegetative cover.

Forage production of 1,300 animal unit months from 6,700 acres will not be available for a five to ten year period until erosion is controlled.

Sediment yield to streams and reservoirs on rangeland will be reduced by half by the improved plant cover and construction of ponds under the range forage measures.

Provides additional 4,000 recreation visitor days for bird watchers.

DEER HABITAT MEASURES

Improves deer habitat on 1,600,000 acres of forested and brush-covered lands.

Increase in deer population.

Brush piling or crushing followed by burning and herbicide spraying on 55,200 acres will improve deer access, forage, and increase "edge habitat."

An increase in sheet and rill erosion is expected as a result of the brush management program.

Provides additional 270,000 animal unit months of grazing for deer on 230,000 acres of reseeded rangeland.

Provides additional 370,000 recreation visitor days of deer hunting and sight-seeing.

WILDFIRE REDUCTION MEASURES

The average annual acreage burned by wildfires will be reduced by 9,300 acres.

Total smoke pollution, soil erosion and sedimentation from burned lands will be reduced.

Prescribed burning will increase.

2. FAVORABLE ENVIRONMENTAL IMPACTS

FLOOD PREVENTION MEASURES

Provides flood protection for 29,800 acres of irrigated cropland from 10 percent storm events.

Provides flood protection for the communities of Cutler, Orange Cove, Orosi, East Orosi, Strathmore, Woodlake and part of Tehachapi from 1 percent storm events.

Provides flood protection for the communities of Mendota, Dinuba, Arvin and Lamont from 10 percent storm events.

Reduces sedimentation downstream of the flood control reservoirs due to the 10,600 acre feet of sediment storage capacity in nine flood control reservoirs.

Creates 3,300 low to medium income jobs for Basin residents in conjunction with drainage and irrigation measures.

DRAINAGE IMPROVEMENT MEASURES

Improves water table and salinity control on 500,000 acres of irrigated cropland to maintain productivity.

Decreases salts added to irrigated cropland soils by 501,000 tons annually.

IRRIGATION IMPROVEMENT MEASURES

Provides water to irrigate an additional 66,000 acres of cropland and pastureland.

Improves upland game habitat on 66,000 acres of cropland and pastureland.

OTHER WATER MANAGEMENT MEASURES

Enhances food supply and nesting cover for migratory waterfowl on 91,000 acres.

Provides an additional 39,700 acres of waterfowl ponds during the period September through March.

Provides 3,000 surface acres of water for fish habitat.

Increases Type 1 wetlands by 12,700 acres, Types 2 and 3 wetlands by 30,800 acres, and Types 4 and 5 wetlands by 2,300 acres.

DEVELOPED CAMPSITES MEASURES

Develops 4,000 campsites on 1,000 acres of forest land.

Provides additional 2.9 million recreation visitor days at campsites.

TIMBER PRODUCTION MEASURES

Maintains present levels of timber production.

WILDERNESS PRESERVATION MEASURES

Preserves 2,900,000 acres of wilderness including 1.4 million acres of the 1.6 million acres in National Parks and 1.5 million acres of the 3.6 million acres in National Forests.

RANGE FORAGE MEASURES

Creates 1,090 ponds on rangeland with a total surface area of 1,090 acres.

Provides potential for warm water fisheries in 500 ponds on rangeland with a surface area of 500 acres.

Provides additional 10,000 recreation visitor days of fishing.

Increases water yield from the 263,500 acres of rangeland converted from brush to grasses and legumes.

Improved grasses and legumes will be seeded on 407,000 acres of rangeland.

Reserves 7,200 acres of rangeland to wildlife habitat for rare and endangered species.

Provides an additional 2.95 million animal unit months of grazing for livestock on 3.4 million acres of rangeland resulting in an additional 134 million pounds of livestock gain on rangeland annually after 1990.

Quail populations will be increased by the addition of 570 watering facilities and 1,150 artificial roosts.

Provides additional 2,300 recreation visitor days of quail hunting.

Creates 1,777 medium income jobs for Basin residents in conjunction with other land treatment measures.

EROSION AND SEDIMENTATION MEASURES

Bank erosion along 800 miles of stream primarily on rangeland will be reduced from 170 acres to 110 acres annually.

Streambelts along 800 miles of streams that include the stream channel plus 50 feet along each side protected from grazing will improve 14,500 acres of habitat for upland game and maintain riparian habitat.

Streambelts along 800 miles of streams will reduce amount of sediment from sheet and rill erosion from adjacent fields reaching streams.

Sedimentation from 6,700 acres of critically eroding rangeland will be reduced by re-establishing vegetative cover.

Sediment yield to streams and reservoirs on rangeland will be reduced by half by the improved plant cover and construction of ponds under the range forage measures.

Provides additional 4,000 recreation visitor days for bird watchers.

DEER HABITAT MEASURES

Improves deer habitat on 1,600,000 acres of forested and brush-covered lands.

Increase in deer population.

Brush piling or crushing followed by burning and herbicide spraying on 55,200 acres will improve deer access, forage, and increase "edge habitat."

Provides additional 270,000 animal unit months of grazing for deer on 230,000 acres of reseeded rangeland.

Provides additional 370,000 recreation visitor days of deer hunting and sight-seeing.

WILDFIRE REDUCTION MEASURES

The average annual acreage burned by wildfires will be reduced by 9,300 acres.

Total smoke pollution, soil erosion and sedimentation from burned lands will be reduced.

Prescribed burning will increase.

3. ADVERSE ENVIRONMENTAL EFFECTS

FLOOD PREVENTION MEASURES

Converts 3,000 acres of the 4,684,200 acres of irrigated cropland and pastureland to flood control structures.

Vegetation in 81 miles of stream channels will be disturbed during channel modification work and is expected to become re-established within five years.

DRAINAGE IMPROVEMENT MEASURES

Increases salts added to 91,000 acres of wildlife land by 240,000 tons annually.

Adds 261,000 tons of salt annually to the San Joaquin River during the high flow months of February, March and April.

Converts 7,300 acres of the 4,684,200 acres of cropland and pastureland to 201 miles of open drainage channels and 6,300 acres of evaporation basins.

IRRIGATION IMPROVEMENT MEASURES

Converts 12 miles of unlined irrigation canals to concrete lined canals.

Destroys wildlife habitat on 12 miles of irrigation canals.

TIMBER PRODUCTION MEASURES

Increases noise, dust, erosion and sedimentation from 620,000 acres of timberland.

WILDERNESS PRESERVATION MEASURES

Converts 60,000 acres of the 1.7 million acres of commercial timber to wilderness.

RANGE FORAGE MEASURES

Eliminates forage production of 500 animal unit months for livestock from 1,090 acres of the five million acres of rangeland converted to ponds.

Ground application of herbicides will be used to treat 121,000 acres of the 257,000 acres of light brush encroachment on rangelands.

Burning followed by aerial and ground application of herbicides will be used to treat 142,500 acres of the 378,500 acres of heavy brush encroachment on rangelands.

Converts 263,500 acres of the 635,500 acres of brush on rangeland to grasses and legumes.

Increase in erosion and sedimentation from 263,500 acres of rangeland during first year of brush management program.

Loss of forage production for livestock of 3,600 animal unit months from 7,200 acres of rangeland converted to wildlife habitat.

EROSION AND SEDIMENTATION MEASURES

Loss of forage production for livestock of 9,700 animal unit months from 14,500 acres of rangeland converted to streambelts.

Loss of forage production of 1,300 animal unit months from 6,700 acres for a five to ten year period until erosion is controlled.

DEER HABITAT MEASURES

An increase in sheet and rill erosion is expected as a result of the brush management program.

4. ALTERNATIVES

Two alternative plans were developed: an NED Alternative Plan and an EQ Alternative Plan. Both alternatives were formulated to solve the problems presented in Chapter V and satisfy the needs shown in Chapter VIII. Both alternatives are discussed in Chapter IX with a comparison shown on Table X-4.

The effects of a "no action" alternative can be quantified by referring to the "Future Under Ongoing Programs" column on Table VIII-1 and then the "Needs" column to see the effects if no recommendations for development are implemented.

In addition to the NED, EQ, and "no action" alternatives, other alternatives were considered to avoid some or all of the major adverse environmental effects of individual measures in the Preferred Plan. These possible alternatives include:

Alternatives to using 3,000 acres for nine flood structures to protect 29,800 acres of irrigated cropland include:

a. Building smaller impoundment structures and enlarging the downstream channels. Grade stabilization structures would be required in the channels and all road crossings extended. Irrigated cropland would be converted to channels and sediment load would not be reduced.
b. Enlarging stream channels in combination with dikes would require even more grade stabilization structures than above and use more irrigated cropland. Road crossings would need to be extended longer and sediment load would not be reduced.
c. Using existing channels and defining the flood plain with dikes would require the most irrigated cropland and restrict the selection of crops. Roads would be impassable during flooding and sediment load increased due to row crop culture.

Alternatives to increasing salts added to 91,000 acres of wildlife land by 240,000 tons annually include:

a. Disposal of drainage effluent in the proposed master drain which transports the problem to another location.
b. Disposal directly into the San Joaquin River system which would be during the summer and fall when river flows are low.
c. Providing good quality water for flushing type irrigations in the Spring after duck ponds are drained into the San Joaquin River system. At least half the salts would be flushed out at a time when the river flows are high. This water would be costly and deplete the supply for producing food and fiber crops.

Alternatives to using 6,300 acres of irrigated cropland for evaporation ponds to dispose of drainage effluent include:

a. Pumping the drainage water from a much smaller collecting pond to a master drain which transports the problem to another location and requires an enlarged drain. Energy requirements would be a continuing requirement.
b. Installing a desalting facility and much smaller evaporation pond to contain the salts and a collecting pond to receive drainage water. Cleaned water would be sold to recover some costs. Energy requirements would be a continuing requirement.

Alternatives to converting 1,000 acres of forest land to 4,000 campsites include:

a. Adoption of a campsite reservation system for all existing publicly owned campsites to increase mid-week and non-holiday utilization of existing campsites. Computer operations and public education would be continuing requirements.
b. Construction of fewer campsites and adoption of a campsite reservation system for all publicly owned campsites. Unsatisfied demand would be diverted to areas outside the Basin or satisfied by other recreation activities through a continuing public education program.

Alternatives to converting 1,090 acres of rangeland to ponds include:

a. Substitution of wells pumped by windmills where water is available and winds blow frequently. There would be no sediment storage so water quality would not be improved. Opportunities for warm water fisheries and recreation fishing would be foregone.
b. Pumping water from a few wells to storage tanks that supply watering troughs would require a continuing energy supply and not reduce sediment in streams or provide warm water fisheries.

5. SHORT-TERM VS. LONG-TERM USE OF RESOURCES

Implementation of the Preferred Plan will maintain crop productivity on 500,000 acres of irrigated cropland that is expected to revert to irrigated pasture and wildlife land if no improvements are installed. An equivalent area would then be developed from the currently non-irrigated cropland and grazing land. This would be in addition to the projected 912,000 acres of new irrigation development by the year 2000. The long-term effect is to defer development of potential cropland.

Disposal of drainage effluent onto wildlife lands after dilution with good quality water is proposed as a short-term solution until the proposed master drain is completed. The proposed drainage improvements in the San Joaquin subbasin are compatible with the proposed master drain.

Improved irrigation efficiency will provide water for 66,000 acres of additional cropland and pastureland into the future.

The additional 39,700 acres of waterfowl ponds will provide resting and feeding area for migrating waterfowl using the Pacific Flyway at a time when urbanization and agricultural development are reducing habitat.

Establishment of the land treatment program on rangeland will continue to keep forage productivity high after the year 2000. The improved vegetative cover will control erosion and, in conjunction with the ponds and streambelts, will continue to reduce sediment pollution in streams.

Setting aside 7,200 acres of rangeland containing critical habitat for rare or endangered species will help maintain them into the future. Lease payments for the grazing development rights will compensate for the lost forage production.

Using streambelts along 800 miles of streams with bank erosion will remove 14,500 acres of rangeland but compensate landowners with lease payments for development rights. Streambelts will continue to reduce bank erosion and sediment pollution from adjacent fields. Vegetation will mature and provide additional habitat for wildlife and improve the visual quality of the landscape for future generations.

6. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Construction of flood control structures would remove 3,000 acres of irrigated cropland and pastureland from production while protecting crop production on 29,800 acres against flooding and improving downstream water quality by removing sediments.

Disposal of drainage effluent by converting 6,300 acres of irrigated cropland to evaporation ponds will remove this land from crop production due to increasing salinity over time. Waterfowl will utilize the ponds part of the year, and the ponds can grow warm water fish during part of the year.

Disposal of drainage effluents on 91,000 acres of wildlife land will increase soil salinity levels and require continuing irrigations each year to maintain plant communities even after drainage effluent is diverted to a proposed master drain.

Old growth timber will be replaced by young growth timber on 1,600,000 acres of land managed for timber production.

Construction of 1,090 ponds on rangeland will forfeit production of 500 animal unit months of grazing annually. All of the ponds will benefit wildlife and half of them will support fisheries and provide 10,000 recreation visitor days.

chapter IV resource base

san joaquin valley basin study

SAN JOAQUIN VALLEY AND THE TEHACHAPI MOUNTAINS

chapter IV resource base

san joaquin valley basin study

The prosperity of the San Joaquin Valley Basin is largely dependent on its resource base.

The study area encompasses almost 28,400 square miles (18.2 million acres). The Basin stretches from the Sacramento—San Joaquin Delta on the north to the crest of the Tehachapi Mountains on the south. East to west it encompasses everything from the crest of the Sierra Nevada to the crest of the Coast Range. This area includes all or part of Alameda, Alpine, Calaveras, Fresno, Kern, Kings, Los Angeles, Madera, Mariposa, Merced, San Benito, San Joaquin, San Luis Obispo, Stanislaus, Tulare, Tuolumne, and Ventura counties (15). The major cities are Modesto, Fresno and Bakersfield. Refer to the Location Map at the beginning of the report.

Within its vast land area, the San Joaquin Valley Basin encompasses flat, fertile flood plains; rich, productive agricultural land; rolling foothills; and towering mountains. Elevations range from sea level near the delta to the highest peak in the contiguous U.S., 14,495 feet on Mt. Whitney. The Basin is ringed on the west, south and east by mountains.

The Basin has a number of unique features. It has some of the most productive agricultural land in the world. In addition to the highest peak, it also has some of the world's largest trees, the Giant Sequoias. The study area includes Yosemite, Sequoia, and Kings Canyon National Parks.

Climate is as varied as the topography. Average annual precipitation varies from about five inches on the valley floor to over 70 inches in the Sierra Nevada. In the mountains, most precipita-

tion comes as snow. The spring snowmelt provides most of the valley's water. Ninety percent of the Basin's precipitation falls between November and March. The climate in the valley is characterized by hot, dry summers and mild winters with relatively little precipitation. Cool summers and cold winters with heavy rain and snow occur in the eastern mountainous areas.

The Basin is composed of two subbasins. The San Joaquin subbasin occupies the northern part and drains through the Sacramento-San Joaquin Delta into San Francisco Bay. The Tulare subbasin occupies the southern portion and is a closed basin.

TABLE IV-1. PRIMARY LAND USE, SAN JOAQUIN VALLEY BASIN, 1972

DESCRIPTION OF LAND USE	TOTAL (Millions of Acres)
Commercial Timber	1.7
Suitable Grazing	5.0
Other Grazing and Timber	1.8
Irrigated, Non-irrigated Cropland and Pasture	4.8
Mineral Production	0.2
Recreation	0.5
Classified Wilderness and Primitive Area	0.5
Non-Classified Wilderness and Roadless Area	2.4
Wildlife	0.3
Water	0.1
Urban-Industrial	0.2
Other	0.7
Total	18.2

LAND RESOURCES

The Basin's land resources are extensive. Of the 18.2 million acres, 73 percent are used primarily for crop, livestock, and timber production. A very small portion of the Basin is used for urban or industrial development. See Table IV-1 and the Land Use and Vegetation maps following page 48.

Land Resource Areas

The five Land Resource Areas found in the Basin emphasize the varied climate and physiography in the study area. They are:

Land Resource Area 15
Central California Coast Range

This area lies west of the San Joaquin Valley and is predominantly hilly to mountainous. Summers are hot and dry and annual precipitation varies from 10 to 20 inches. Elevations range from 500 to 2,500 feet.

Land Resource Area 17
Sacramento-San Joaquin Valleys

This area includes the San Joaquin Valley adjacent to the San Joaquin River, fans and flood plains of tributary streams, and adjacent terraces. Elevations range from sea level to 500 feet. Winters are cool and rainy with hot, dry summers.

Land Resource Area 18
Sierra Nevada Foothills

This area lies to the south and east of the San Joaquin Valley. It is characterized by rolling to hilly relief and is dissected by numerous streams. Elevations range from 500 feet to 1,500 feet. Precipitation decreases from 35 inches in the north to 14 inches in the south.

Land Resource Area 20
Southern California Mountains

This area lies to the southwest of the San Joaquin Valley and includes the steep mountainous areas above 2,000 feet elevation. Annual precipitation is generally 16 to 30 inches occuring mostly in the winter but with scattered summer showers.

Land Resource Area 22-Sierra Nevada

This area lies to the east of the San Joaquin Valley at elevations above 1,500 feet. It is characterized by hilly to steep mountainous relief with occasional mountainous valleys. Annual precipitation varies from 35 inches to as high as 100 inches with a large part being snow in the high mountains.

Soil

Soil resources were compiled into 66 soil groups made up of one or more extensive soils similar in general soil characteristics with the inclusion of minor areas of soil that may or may not be like the dominant soils within the area (14).

Twenty-three soil groups were judged suitable for sustained use under irrigation. Suitability of the 55 most important crops on these irrigable soil groups was used as a basis for making yield estimates. Yield estimates reflect the variability due to soil differences (13).

Applied water requirements were developed for the suitable crops reflecting differences between soil groups (12). Soil group descriptions were used to help define drainage problem areas and potential problem areas. Estimated crop yield reductions due to drainage problems also reflect soil differences (9).

Ten range sites on grazing land were interpreted from 42 soil groups. Forage production estimates on these sites also reflect soil differences (11).

Land Ownership

Even though the Basin contains three National Parks, one National Monument, and all or part of five National Forests, most of the land is privately owned. Sixty-five percent of Basin land is private, compared to the national average of 58 percent and a state average of 52 percent. See the Land Ownership Maps following page 48.

Approximately 80 percent of the Basin's commercial forest land is in the National Forests. Other public ownership accounts for less than 0.5 percent with the remaining 20 percent in private ownership.

Other public lands include small parcels administered by the Army, Navy, Air Force, U.S. Fish and Wildlife Service, and Army Corps of Engineers. The Bureau of Land Management administers approximately 825,000 acres. The Tule River Indian Reservation covers about 50,000 acres. State administered lands include parks, wildlife areas, and reservoirs. Local agencies manage areas for water, public utilities, and schools.

TABLE IV-2. LAND OWNERSHIP/ADMINISTRATION, SAN JOAQUIN VALLEY BASIN, 1972

OWNERSHIP	TOTAL (Millions of Acres)
Private	11.7
Bureau of Land Management	0.8
National Forests	3.6
National Parks	1.6
Other Federal	0.2
State and Local Government	0.3
Total	18.2

Agricultural Land

Agriculture is the dominant land use in the San Joaquin Valley Basin. Fifty-eight percent of the valley's land is in farms.

A detailed account of the economic importance of agriculture is given in Chapter VI.

Cropland

The Basin has 4.8 million acres of cropland which represents approximately one-half of California's cropland. Most of this is concentrated down the central, flatter portion of the valley, with some orchards and vineyards extending into the lower foothills. Land in the valley trough and on the west side tends to be affected by drainage problems (Chapter V).

The valley's cropland covers 26 percent of the 18.2 million-acre land base. Row crops account for 62 percent of the cropland, fruits and nuts 23 percent, vegetables 5 percent and irrigated pasture 10 percent.

ALMOND ORCHARD WITH ANNUAL GRASS STRIP COVER CROP

Virtually all of the valley's cropland is privately owned.

Most of the Basin's cropland relies on irrigation for its existence. In the San Joaquin subbasin, 94 percent of the cropland is irrigated. In the Tulare subbasin 98 percent is irrigated. For the overall Basin, 97 percent of the cropland is irrigated.

An additional 2,205,200 non-irrigated acres are suitable for irrigation (Table IV-3). This land is not irrigated primarly due to lack of water for irrigation. Of this, 850,400 acres are in the San Joaquin subbasin and 1,354,800 acres in the Tulare subbasin.

TABLE IV-3. IRRIGATED AND NON-IRRIGATED CROPLAND, SAN JOAQUIN VALLEY BASIN, 1972

	Total
Irrigated Cropland	4,684,200 acres
Non-irrigated Cropland	158,300 acres
Total Cropland	4,842,500 acres
Suitable but not Irrigated Land a	2,205,200 acres
Potentially Irrigable	6,889,400 acres

a Additional land that could have been irrigated but was not cropped for various reasons

Rangeland

The San Joaquin Valley Basin has approximately 5,000,000 acres of suitable rangeland. This represents 28 percent of the total land area. Nearly 600,000 acres are administered by the U.S. Forest Service with ranchers leasing parcels of land to graze livestock. Much of the land classified as range is also referred to as part of forest and brush-covered lands. Grazing and timber production often occur on the same land (Table IV-4).

Most of the rangeland is brush-covered lands in the foothills with some on the valley floor. Rangeland is also important watershed land, since most of the precipitation falls in the foothills and mountains. Therefore, the Basin's rangeland provides water, as well as livestock forage and recreation. See the Range Site maps following page 48.

TABLE IV-4. RANGELAND ACREAGE AND FORAGE PRODUCTION BY OWNERSHIP/ADMINISTRATION, SAN JOAQUIN VALLEY BASIN, 1972

OWNERSHIP	LAND USED FOR GRAZING (Acres)	ANNUAL RANGE FORAGE PRODUCTION (AUM's)
1 Private	3,983,000	2,477,000
2 National Forest	599,000	88,000
3 National Resource (BLM) and Other Public Land	400,000	83,000
Total	4,982,000	2,648,000

Source: USDA River Basin Planning Staff estimates.

Dairy products account for 10 percent of the San Joaquin Valley Basin agricultural production. Cattle and calves produce 22 percent of the total output. Other livestock and their products account for less than 1 percent of the Basin's production.

The economic importance of the Basin's rangeland is discussed in Chapter VI.

COULTER PINES IN SIERRA FOOTHILLS

Forest Land

Forest and brush-covered lands ring the Basin on the west, south and east. These lands cover 8.7 million acres; 48 percent of the Basin's land. About 5.2 million acres are in National Parks and National Forests. A majority of the remaining 3.1 million acres is privately owned, with 400,000 acres administered by the Bureau of Land Management (Table IV-2 and Table IV-5). The forest and brush-covered lands provide timber, recreation, water, fish and wildlife habitat and range forage.

For a more detailed description of the economic importance of the Basin's forest resources see Chapter VI.

CAMPGROUND IN STANISLAUS NATIONAL FOREST

TABLE IV-5. CURRENT SUPPLY OF COMMERCIAL FOREST LAND BY OWNERSHIP/ADMINISTRATION, SAN JOAQUIN VALLEY BASIN

OWNERSHIP	CURRENT SUPPLY
National Forest	1,327,000 acres
Other Public	8,000 acres
Private	352,000 acres
Total	1,687,000 acres

Source: Oswald, Daniel D., *California's Forest Industries — Prospects for the Future*, Forest Service, 1970.

Recreation

Many of the Basin's outdoor recreation areas are in the forest and brush-covered lands. Some State and local recreation facilities are located on the valley floor.

The three National Parks in the Basin cover 1.6 million acres and provide a large share of the recreation opportunities. Yosemite National Park is one of the most renowned and popular parks in the world. Kings Canyon, Sequoia, and Yosemite National Parks provide hiking, fishing, horseback riding, backpacking, skiing, camping, picnicking, and other recreational pursuits.

The 3.6 million acres of National Forests in the Basin are managed for multiple use. The Inyo, Los Padres, Sequoia, Sierra, and Stanislaus National Forests offer scenic and recreational attractions.

SKIING IN STANISLAUS NATIONAL FOREST

TABLE IV-6. CAMPSITE INVENTORY BY OWNERSHIP/ADMINISTRATION, SAN JOAQUIN VALLEY BASIN, 1975

OWNERSHIP	NUMBER OF CAMPGROUNDS	NUMBER OF CAMPSITES
Federal		
National Park Service	30	3,795
National Forest	120	3,751
Corps of Engineers	12	1,015
Bureau of Land Management	2	49
State of California	7	410
Local Government	15	1,173
Private	16	1,188
All Ownerships	202	11,381

Source: California-Nevada Camping, American Automobile Association, 1976; and River Basin Planning Staff estimates.

Turlock Lake, McConnell, Millerton Lake, San Luis Reservoir, Fremont Ford, and George J. Hatfield State Recreation Areas; Colonel Allensworth and Columbia State Historic Parks; Caswell Memorial State Park and Tule Elk State Reserve offer still more recreational opportunities. Many of these are in the valley or lower foothills. Water-based recreation is a major attraction of State Parks. They also offer picnicking, camping, hiking, and other activities.

Reservoirs owned by private or municipal utilities or special districts provide even more recreation. In addition, counties and cities operate a number of parks.

An inventory of the current number of campsites is shown on Table IV-6.

Wilderness

All of the Basin's classified wilderness land (about 0.5 million acres) is within the National Parks or National Forests. Classified wilderness is land in the National Wilderness Preservation System or Primitive Areas. This land is legally defined as wilderness. Existing inventories indicate an additional 2.4 million acres can be described as having wilderness characteristics. These inventories are being updated in the 1977 Roadless Area Review and Evaluation (RARE II).

Fish and Wildlife

Five species of endangered and nine species of rare animals live in the Basin. The endangered species are: thicktail chub, blunt-nosed leopard lizard, California condor, Southern bald eagle, and peregrine falcon. The rare species are: Little Kern golden trout, Tehachapi slender salamander, Kern Canyon slender salamander, limestone salamander, Southern rubber boa, giant garter snake, prairie falcon, spotted owl, Fresno kangaroo rat, San Joaquin kit fox, spotted bat, wolverine and California bighorn sheep.

Five species of anadromous fish use the San Joaquin River drainage: Pacific lamprey, white sturgeon, American shad, striped bass, and king salmon. Anadromous fish spend part of their life in the ocean and migrate into fresh water streams to spawn.

Freshwater fish are subdivided into warm and cold water species. Most of the warm water fish live in low elevation streams, canals, lakes and reservoirs. Cold water fish live primarily in mountain lakes, streams annd reservoirs. Four species of trout are the most common cold water fish: golden, rainbow, brown and eastern brook trout.

The San Joaquin Valley Basin offers a variety of habitat types. A description of the different habitat types is included in Table IV-7. Big-game habitat is located mainly in the eastern foothills of the coastal mountains and in the Sierras. Mule deer, black bear and wild pigs are the major game species. Upland game habitat is found in the lower elevation foothills and on the valley floor, where competition with agriculture is strong. Waterfowl habitat is located primarily along the west side of the Basin.

PINTAIL DUCKS USING DEVELOPED WETLAND

Deer are the most abundant large-animal species. They are flexible in their use of habitat types, with two-thirds of their range in the National Parks and Forests on the east side of the Basin. Deer habitat in the Basin is steadily declining (Chapter V).

The Tule elk is protected on the Tupman Tule Elk Preserve in Kern County. Recently transplanted elk are also now protected on the San Luis Wildlife Refuge in Merced County.

Much of the upland game habitat has been modified by irrigated agriculture. Intensive cultivation and double cropping limit the value of agricultural land as habitat. Major upland game species in the valley include dove, quail, pheasant, and rabbits.

The San Joaquin Valley Basin is a major waterfowl wintering area. Between 1965 and 1975, one-fourth of the waterfowl in the State were found in the Basin. Wintering areas are provided on a number of State and Federal facilities as well as some private lands. There are 33,117 acres of Federally owned wetlands; 18,500 acres State owned; and 97,355 acres privately owned. In the San Joaquin subbasin there are five major wetland management areas: Kesterson, San Luis and Merced National Wildlife Refuges and Los Banos and Volta Wildlife Management Areas. In the Tulare subbasin Kern and Pixley National Wildlife Refuges and the Mendota Wildlife Area provide wetland habitat.

FAWN IN STANISLAUS NATIONAL FOREST

TABLE IV-7. WILDLIFE HABITATS, SAN JOAQUIN VALLEY BASIN

HABITAT	CHARACTERISTICS	WILDLIFE
Riparian	Along streams and sloughs Willows, Cottonwood, alder, wild grape	Supports widest variety of wildlife. Dove, pheasant, quail, waterfowl, songbirds, rabbits, fur bearers.
Marshland	Shallow water area, water all year. Cattail, tule, pickleweed, alkali bullrush.	Waterfowl, shore birds, water-associated birds, variety of mammals, reptiles, amphibians, raptors.
Grassland	Open grass land, dry in summer, growth in winter. Used for grazing annual grasses, forbs.	Meadowlarks, rabbits, squirrels, reptiles. Once home of pronghorned antelope
Oak Woodland-Grass	Lower foothill areas. Dry summers Grasses and forbs with scattered live and blue oak, California buckeye Used for grazing.	Acorn woodpecker, California ground squirrel, mule deer.
Chaparral	Foothills Chamise, manzanita, ceanothus, oaks, chaparral pea, yerba santa, woody plants	Mule deer, quail, brush rabbit, fur bearers, grey fox, skunk. Old stands support little wildlife.
Valley Scrub	Low foothills and valley floor, very dry Kern County has majority of this habitat type Mesquite, atriplex, saltbush. Conversion to agriculture	Dove, quail, rabbits Endangered San Joaquin kit fox, blunt-nosed leopard lizard
Agriculture	Cropland, orchards Irrigated and non-irrigated	Quail, pheasant, some deer, hawks, owls, insects, rodents.
Lakes-Reservoirs	One natural lake—Tulare. Largest reservoirs San Luis, Hidden, Buchanan, Millerton Lakes and several hundred mountain lakes	Poor habitat because of water fluctuations. Some warmwater fish.
Woodland-Chaparral	Foothills Mixture of broadleaf trees, scrub species and grasses Oaks and some digger pine present	Deer, rabbits, squirrels, other nongame mammals, upland game. Good habitat for many wildlife species.
Minor conifer	Pinyon-pine and juniper Scattered stands of unique conifers cypress, bishop, monterey torrey pines	Elk, bighorn sheep, coyote, upland game birds, rabbits, bobcat, many others
Pine-Fir-Chaparral	Yellow pine belt, 3000-5000 feet. Ponderosa Jeffrey, sugar pine White, Douglas Fir, Oaks, scattered manzanita, ceanothus Timber area	Summer deer range, bobcat, black bear, coyote, beaver, fur bearers, upland game birds, song birds, many more
Sub alpine Forest	Above yellow pine belt to timberline Lodgepole pine, red fir, Aspen.	Mountain quail, blue grouse, red fox, pine marten, other fur bearers.
Alpine	Above timberline	Bighorn sheep, wolverine, rosy finch, Clark's nutcracker
Urban-Industrial	Includes city & suburban areas and man-made barren areas such as highways	Excludes most wildlife, but some species benefit. Songbirds, pigeons, starlings, mourning doves.

Much of the Basin's waterfowl habitat is provided on private lands. In Merced County, landowners can sign a Waterbank Agreement with USDA and receive payment for keeping their land in wetland. Currently, 11,266 acres are covered by these agreements. The "Grasslands" area of Merced County, including waterbank land, provides 92,320 acres of waterfowl habitat during part or all of the year.

Wildlife distribution maps can be found in the Fish and Wildlife Resources Mini-Report (10).

WATER RESOURCES

Water is a critical and limiting resource in the San Joaquin Valley Basin. The agriculturally oriented economy relies on water for its existence.

Historically, water had been an uncertain commodity in the Basin. In the winter the valley was often covered with water from numerous floods; in the summer it was a virtual desert.

Not long after the Gold Rush, when people started moving into the Basin in larger numbers, the first water diversion dams were built. Since then, numerous water control structures have been built, and the seasonal distribution of water has been brought almost entirely under man's control. Water supply and use in the Basin are shown on Figure IV-1 and Table IV-8.

TABLE IV-8. WATER SUPPLY AND USE, SAN JOAQUIN AND TULARE SUBBASINS, SAN JOAQUIN VALLEY BASIN, 1972 *a*

	SAN JOAQUIN SUBBASIN	TULARE SUBBASIN	TOTAL BASINWIDE
	(Thousands of Acre Feet)		
SUPPLY			
Imported Water	3,274	3,084	3,274
Surface	4,151	2,362	6,513
Ground Water Yield	1,866	5,789	7,655
Ground Water Overdraft	250	1,311	1,561
USE			
Gross Applied Agricultural Water	5,704	10,888	16,592
Municipal and Industrial	192	363	555
Recreation and Wildlife	91	43	134
Exported	3,324	109	349

a Based on DWR Bulletin No 160-74, and DWR supporting data.

RESERVOIR IN FRESNO COUNTY

Surface Water

There are numerous streams and rivers leading into the Basin. Most of the year-round streams originate in the Sierras. Those that flow into the Basin from the coastal mountains are usually dry in the summer.

In the San Joaquin subbasin, the Stanislaus, Tuolumne, Merced, Chowchilla, and Fresno Rivers originate in the Sierras and drain into the San Joaquin River. The San Joaquin River then flows north into the San Joaquin—Sacramento Delta.

The Tulare subbasin is bounded by mountains on three sides, with a low divide separating it from the San Joaquin Subbasin to the north. As a result, its major rivers, the Kings, Tule, Kaweah, and Kern, have no natural outlet from the Tulare subbasin.

Before dams were constructed in the mountains, the Tulare subbasin was a shallow lake. In very wet years, the lake would flood enough to flow over the divide and into the San Joaquin subbasin where it would drain into the San Joaquin River. The last time this happened was 1878 (2).

The only outlets for water in the Tulare subbasin today are evaporation, percolation, or man-made export systems. Only a small portion of Tulare Lake remains.

There are few natural lakes in the San Joaquin Valley Basin; most of the lakes are associated with dams. The natural lakes that are present are high mountain lakes (except Tulare Lake), and they do not contribute to the Basin's water supply.

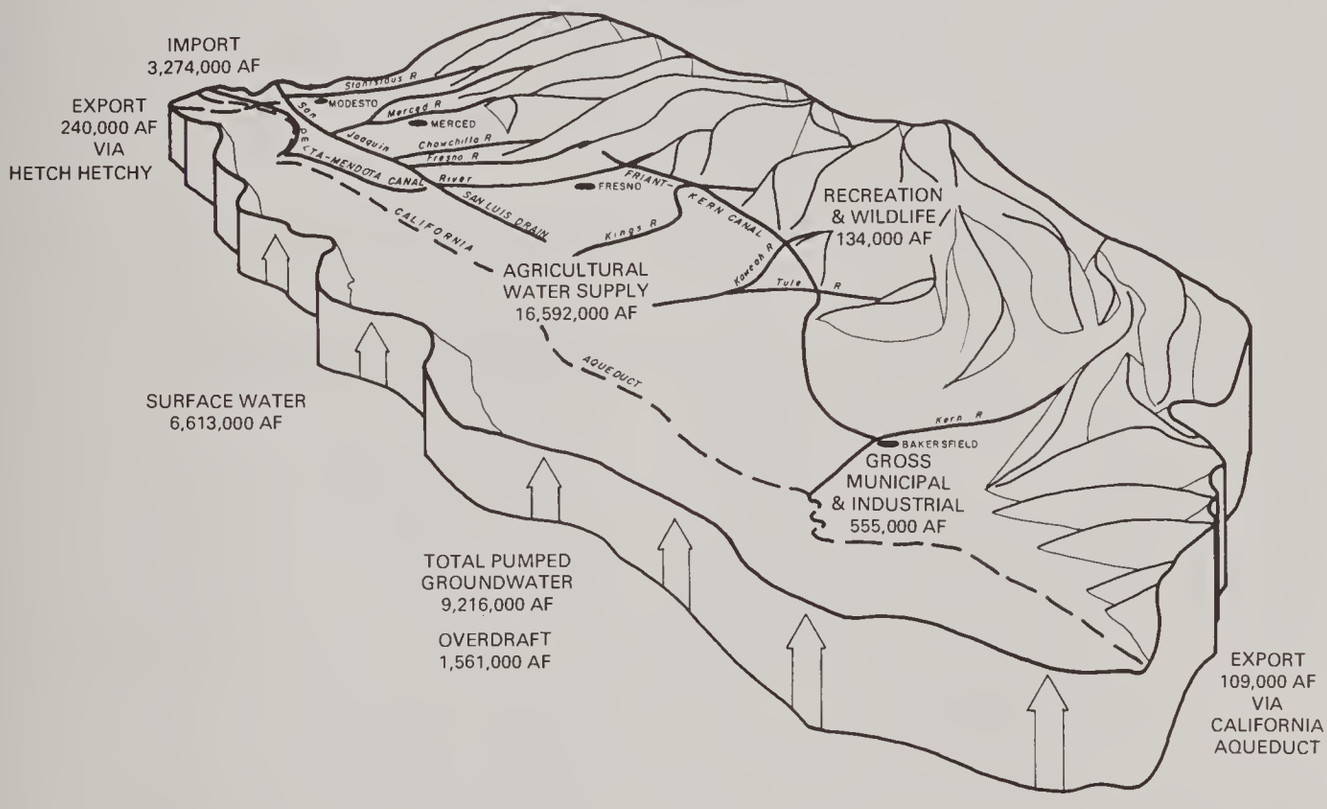
Groundwater

Groundwater is an important water supply in the San Joaquin Valley Basin. The heavy reliance of agriculture on groundwater is evidenced by the annual overdraft in both subbasins of 1.56 million acre feet.

Groundwater supplies 33 percent of the agricultural water in the San Joaquin subbasin and 30 percent in the Tulare subbasin.

The San Joaquin Valley Basin has the largest groundwater supply of any of the State's river basins. The San Joaquin subbasin has an estimated groundwater storage capacity of 95.8 million acre feet. In the Tulare the storage capacity is estimated to be 187 million acre feet (7). This means the San Joaquin Valley Basin has a potential storage capacity of 282.8 million acre feet. Of course, the actual amount of water stored in the underground basins is less than this because each year more water is removed than is replaced.

FIGURE IV-1. WATER RESOURCES, SAN JOAQUIN VALLEY BASIN, 1972



CALIFORNIA AQUEDUCT — A MAJOR CEMENT LINED CANAL USED IN TRANSPORTING WATER FROM NORTHERN CALIFORNIA.

Water Projects

There are two major water projects in California, the Federal Central Valley Project and the California State Water Project. Both supply water to the San Joaquin Valley Basin.

The Central Valley Project is designed to redistribute water within the Central Valley (San Joaquin Valley and Sacramento Valley). In the San Joaquin Valley Basin, San Luis Reservoir, O'Neill Forebay, Los Banos Reservoir, Millerton Lake (Friant Dam), and New Melones Reservoir all provide storage for Central Valley Project water. The major canals distributing this water are: Delta-Mendota, San Luis, Madera, and Friant-Kern. Generally, this water stays within the Basin.

The California State Water Project regulates water runoff in northern California for distribution to the San Francisco Bay Area, San Joaquin Valley, Central Coast, and southern California. The major feature of the California State system in the San Joaquin Valley Basin is the California Aqueduct which conveys water to and through the Basin.

A number of other water control projects are operated in the Basin. Many are Federal projects. Others are operated by irrigation districts. Southern California Edison and Pacific Gas and Electric Company operate a number of reservoirs for power supplies. The City and County of San Francisco export 240,000 acre-feet of water from the Basin annually via the Hetch-Hetchy aqueduct. Table IV-9 identifies the major reservoirs in the Basin.

HUMAN RESOURCES

The San Joaquin Valley Basin contains almost 1.4 million people. This was about 7 percent of the state population in 1970.

Although approximately 68 percent of the Basin's people live in urban areas, it is still a relatively rural area. This is much lower than the Statewide average of 91 percent urban dwellers (Figure IV-2).

Fresno, Modesto and Bakersfield are the major population centers due to their location on transportation routes and their role as buying, processing, and shipping centers for agricultural products. Fresno, with 171,305 people in 1970, is the largest city.

CULTURAL RESOURCES

The Basin is rich in cultural resources. Known archaeological sites are recorded at major universities and by the State Historic Preservation Officer in the California Department of Parks and Recreation. Prior to construction of USDA water resource projects and implementation of land management activities on National Forest lands, an environmental assessment is performed that includes a search of archaeological records and a field reconnaisance survey. New sites are inventoried and either physically protected or saved by altering the project. The Environmental Impact Statement procedures for Federal projects and the Environmental Impact Report procedures for state and local projects have accelerated the discovery of archaeological sites.

TABLE IV-9. LAKES AND RESERVOIRS LARGER THAN 10,000 ACRE FEET CAPACITY, SAN JOAQUIN VALLEY BASIN

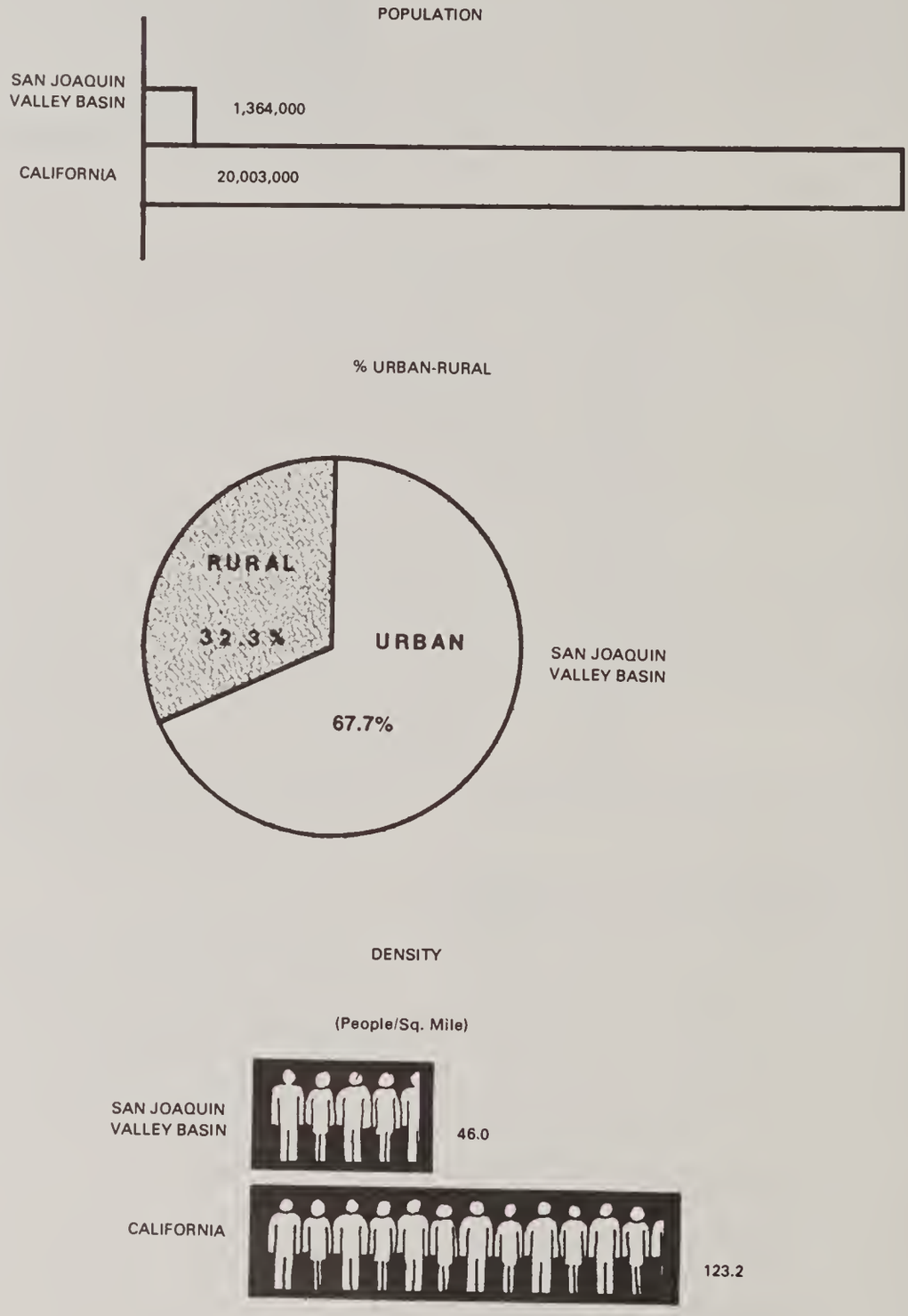
NAME	COUNTY	OWNER-OPERATOR	YEAR BUILT	PURPOSE[a]
Bass Lake	Madera	PG & E	1910	P
Beardsley Reservoir	Tuolumne	Oakdale-San Joaquin	1957	C,I,P
Big Dry Creek Reservoir	Fresno	Corps of Engineers	1948	F
Buena Vista Lake	Kern	Kern County Land Company	1890	I
Cherry Valley Reservoir	Tuolumne	City/County San Francisco	1956	C,M,F,P
Courtright Reservoir	Fresno	PG & E	1958	P
Dallas-Warner Reservoir	Stanislaus	Modesto Irrigation District	1911	F
Don-Pedro Reservoir	Tuolumne	Turlock & Modesto Irrigation District	1971	C,I,F,P
Donnells Island Lake	Tuolumne	Oakdale & San Joaquin Irrigation District	1958	C,I,P
Farmington Flood Control Basin	San Joaquin	Corps of Engineers	1951	F
Florence Lake	Fresno	Southern California Edison	1926	P
Hetch-Hetchy Reservoir	Tuolumne	City/County San Francisco	1923	C,M,F,P
Huntington Lake	Fresno	Southern California Edison	1917	P
Isabella Reservoir	Kern	Corps of Engineers	1953	C,I,F
Kaweah Lake	Tulare	Corps of Engineers	1961	I,F,R
Lake Eleanor	Tuolumne	City/County San Francisco	1918	C,M,F,P
Los Banos Detention Reservoir	Merced	U.S. Bureau of Reclamation	1965	F,R
Mammoth Pool Reservoir	Fresno	Southern California Edison	1960	P
Mariposa Reservoir	Mariposa	Corps of Engineers	1948	F
McClure Lake	Mariposa	Merced Irrigation District	1926	I,P,R
Millerton Lake	Fresno	U.S. Bureau of Reclamation	1947	I,F
O'Neil Forebay	Merced	U.S. Bureau of Reclamation	1967	C,I,M,R,P
Pinecrest Lake	Tuolumne	PG & E	1910	I,M,P
Pine Flat Reservoir	Fresno	Corps of Engineers	1954	C,I,F
Redinger Lake	Fresno	Southern California Edison	1951	P
Relief Reservoir	Tuolumne	PG & E	1910	I,M,P
San Luis Reservoir	Merced	California DWR/U.S. Bureau of Reclamation	1967	C,I,M,R,P
Shaver Lake	Fresno	Southern California Edison	1927	P
Success Reservoir	Tulare	Corps of Engineers	1961	C,I,F,R
Thomas A. Edison Lake	Fresno	Southern California Edison	1954	P
Turlock Lake	Stanislaus	Turlock Irrigation District	1915	C,I
Wishon Reservoir	Fresno	PG & E	1957	P
Woodward Reservoir	Stanislaus	South San Joaquin Irrigation District	1918	I
Buchanan Reservoir	Madera	Corps of Engineers		C,I,F,R
Hidden Reservoir	Madera	Corps of Engineers		C,I,F,R
New Melones Reservoir	Calaveras	Corps of Engineers		C,I,P,F,R

Source: *Lakes, Reservoirs, and Wetland Areas; Total Water Management Study for the Central Valley Basin California*, Working Document No. 3C, August, 1975, U.S. Department of Interior, Bureau of Reclamation.

a. Purpose abbreviations:

I — Irrigation
M — Municipal and industrial
F — Flood control
R — Recreation
P — Power
D — Debris Control
N — Navigation
C — Conservation

FIGURE IV-2. HUMAN RESOURCES, SAN JOAQUIN VALLEY BASIN, 1970



LAND USE

- Timber
- Timber and Grazing
- Grazing
- Grazing and Mineral Production
- Irrigated Cropland and Pastureland
- Non-Irrigated Cropland and Pastureland
- Mineral Production
- Recreation
- Wilderness and Primitive Areas
- Wildlife
- Urban-Industrial
- Water
- Other

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Corta. Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA SCS PORTLAND OR 1978

LAND USE
SAN JOAQUIN SUBBASIN
SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

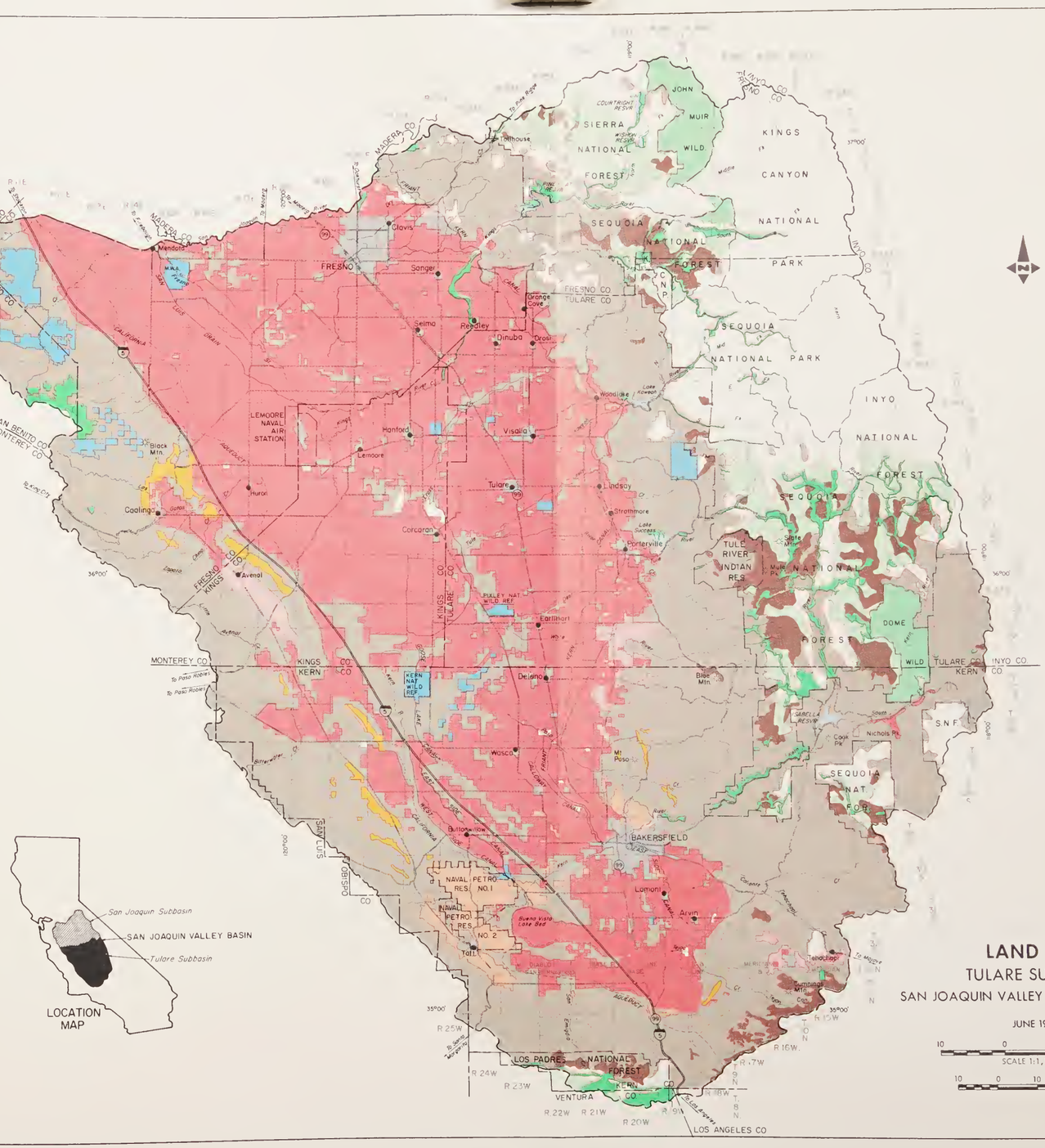
M7-SN-23488-2

LAND USE

- Timber
- Timber and Grazing
- Grazing
- Grazing and Mineral Production
- Irrigated Cropland and Pastureland
- Non-Irrigated Cropland and Pastureland
- Mineral Production
- Recreation
- Wilderness and Primitive Areas
- Wildlife
- Urban-Industrial
- Water
- Other

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Cartog. Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.



LAND USE
TULARE SUBBASIN
SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

M7-SN-23490-2

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VEGETATION

- Coniferous Forest
- Pinyon - Juniper
- Grass and [illegible] Forbs
- Coastal Sagebrush
- Hardwoods and Grass
- Hardwood Forest
- Chaparral and Mountain Brush
- Other
- Water

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carto. Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.

VEGETATION
SAN JOAQUIN SUBBASIN
SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

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M7-SN-23488-3

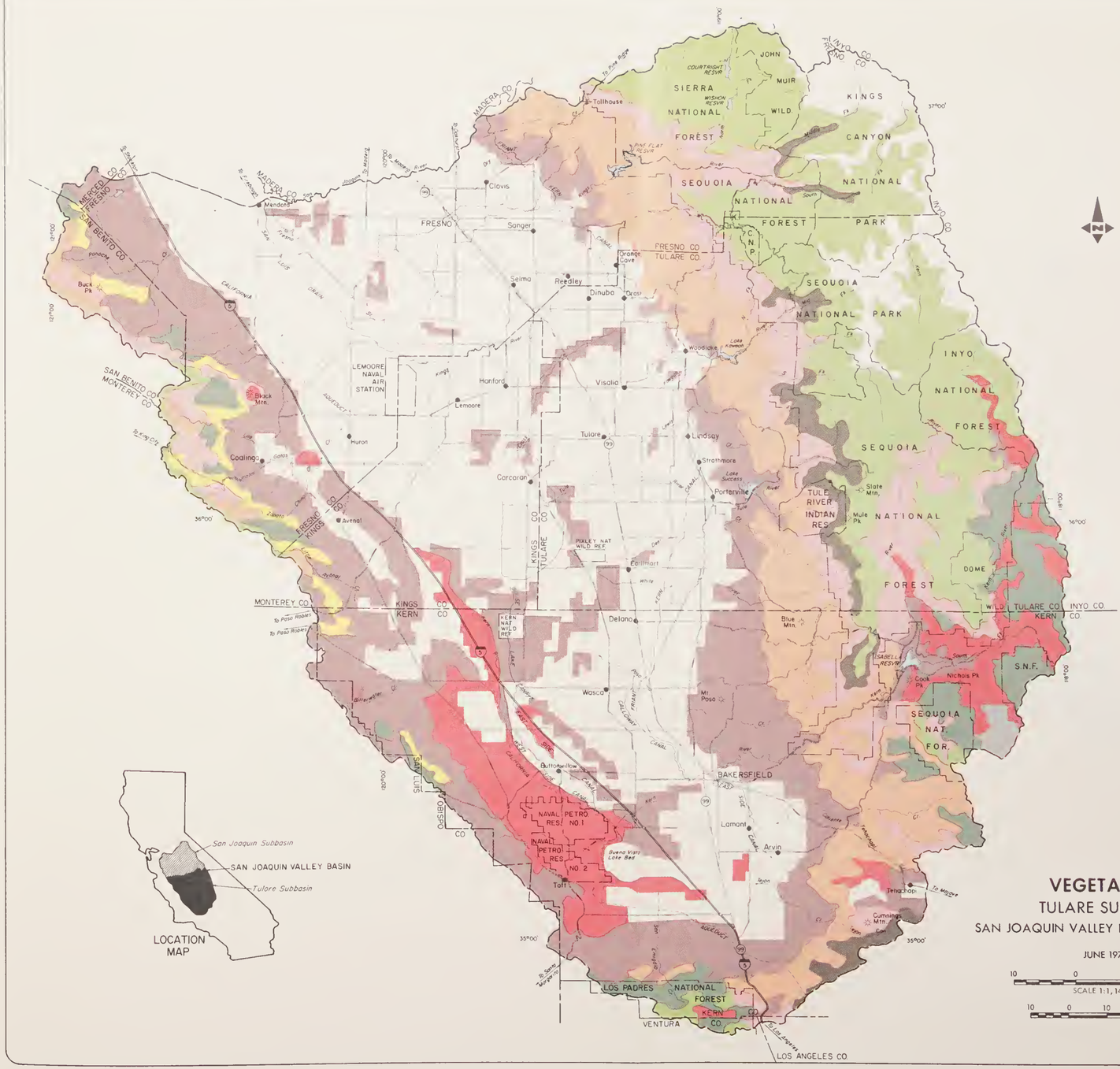
VEGETATION

- Coniferous Forest
- Pinyon-Juniper
- Grass and Forbs
- South Desert Shrub
- Coastal Sagebrush
- Hardwoods and Grass
- Hardwood Forest
- Chaparral and Mountain Brush
- North Desert Shrub
- Other
- Water

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Corto., Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA SCS PORTLAND OR 1976



VEGETATION
TULARE SUBBASIN
SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

M7-SN-23490-3

LAND OWNERSHIP AND ADMINISTRATION

- Forest Service
- Bureau of Land Management
- Fish and Wildlife Service
- National Park Service
- Army, Navy, Air Force
- Corps of Engineers (Civil)
- State Land
- County, City, School District and Special District
- Indian Tribal Trust Land
- Individual or Corporate
- Water

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Corto. Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.

LAND OWNERSHIP AND ADMINISTRATION

SAN JOAQUIN SUBBASIN

SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA SCS PORT. AND OR 1976

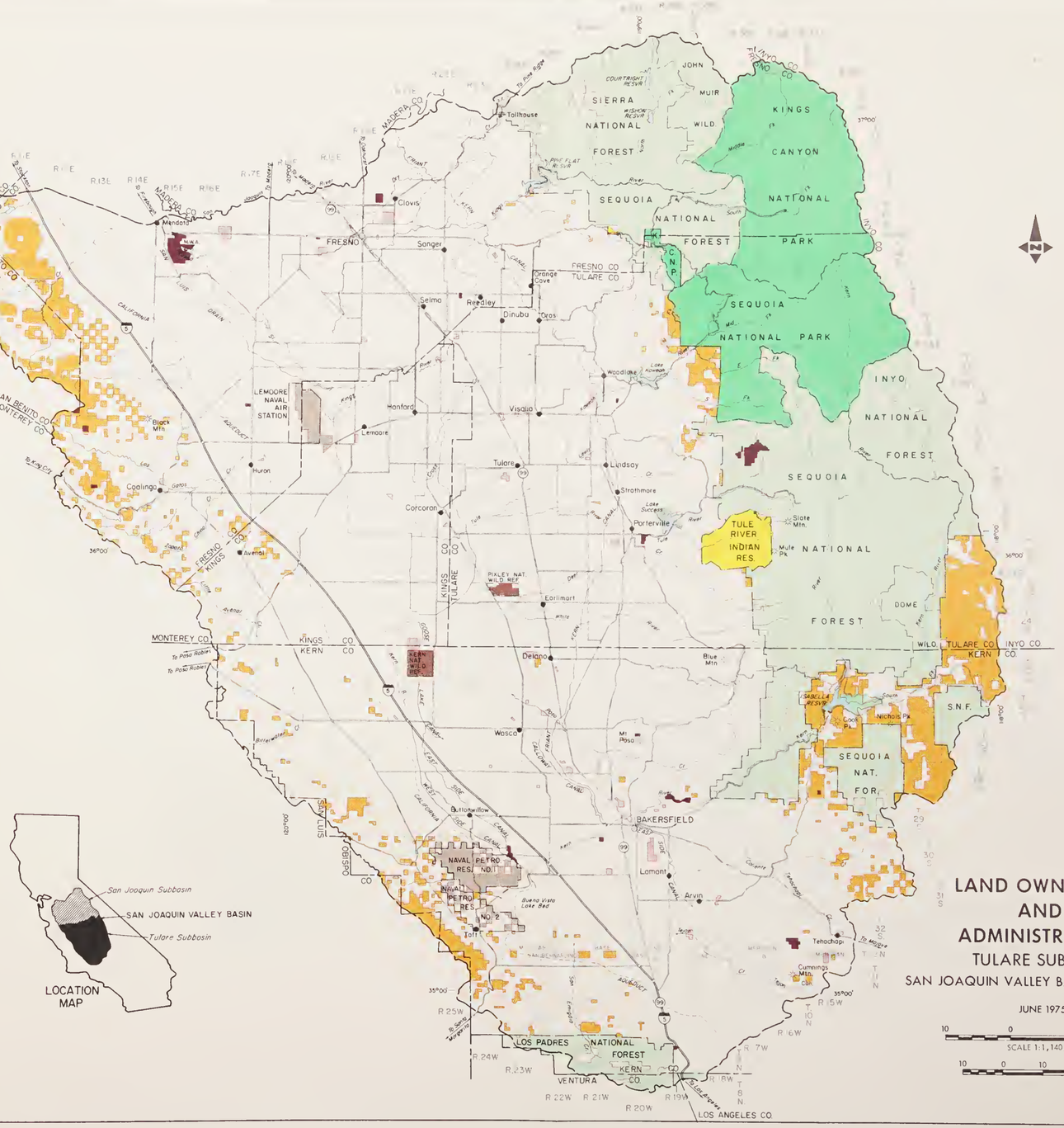
M7-SN-23488-6

LAND OWNERSHIP AND ADMINISTRATION

- Forest Service
- Bureau of Land Management
- Fish and Wildlife Service
- National Park Service
- Army, Navy, Air Force
- Corps of Engineers (Civil)
- State Land
- County, City, School District and Special District
- Indian Tribal Trust Lands
- Individual or Corporate
- Water

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carto Unit from California State Staff compilation.
Thematic detail compiled by California State Staff.



LAND OWNERSHIP AND ADMINISTRATION

TULARE SUBBASIN

SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA SCS PORTLAND OR 1975

M7-SN-23490-6

RANGE SITE AVAILABILITY FOR DEVELOPMENT

AVAILABLE FOR DEVELOPMENT (Private and Corporate Ownership)

- Suitable for Irrigation Development
- Suitable for Woodland
- Not Suitable for Irrigation or Woodland
- Not Considered Available for Development (Includes publicly administered range sites)

RANGE SITES

- Loamy
- Shallow Loamy
- Shallow Coarse Loamy
- Very Shallow Loamy
- Clayey
- Claypan
- Terrace
- Serpentine
- Granitic
- Not Considered A Range Site

- Water
- National Forest Boundary
- Mean Annual Precipitation (Inches)

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carta Unit from California State Staff compilation.
Thematic detail compiled by California State Staff.

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

RANGE SITE AVAILABILITY FOR DEVELOPMENT

SAN JOAQUIN SUBBASIN

SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES

SCALE 1:1,140,000

10 0 10 20 30 KILOMETERS

M7-SN-23488-9

RANGE SITE AVAILABILITY FOR DEVELOPMENT

AVAILABLE FOR DEVELOPMENT (Private and Corporate Ownership)

- Suitable for Irrigation Development
- Suitable for Woodland
- Not Suitable for Irrigation or Woodland
- Not Considered Available for Development (Includes publicly administered range sites)

RANGE SITES

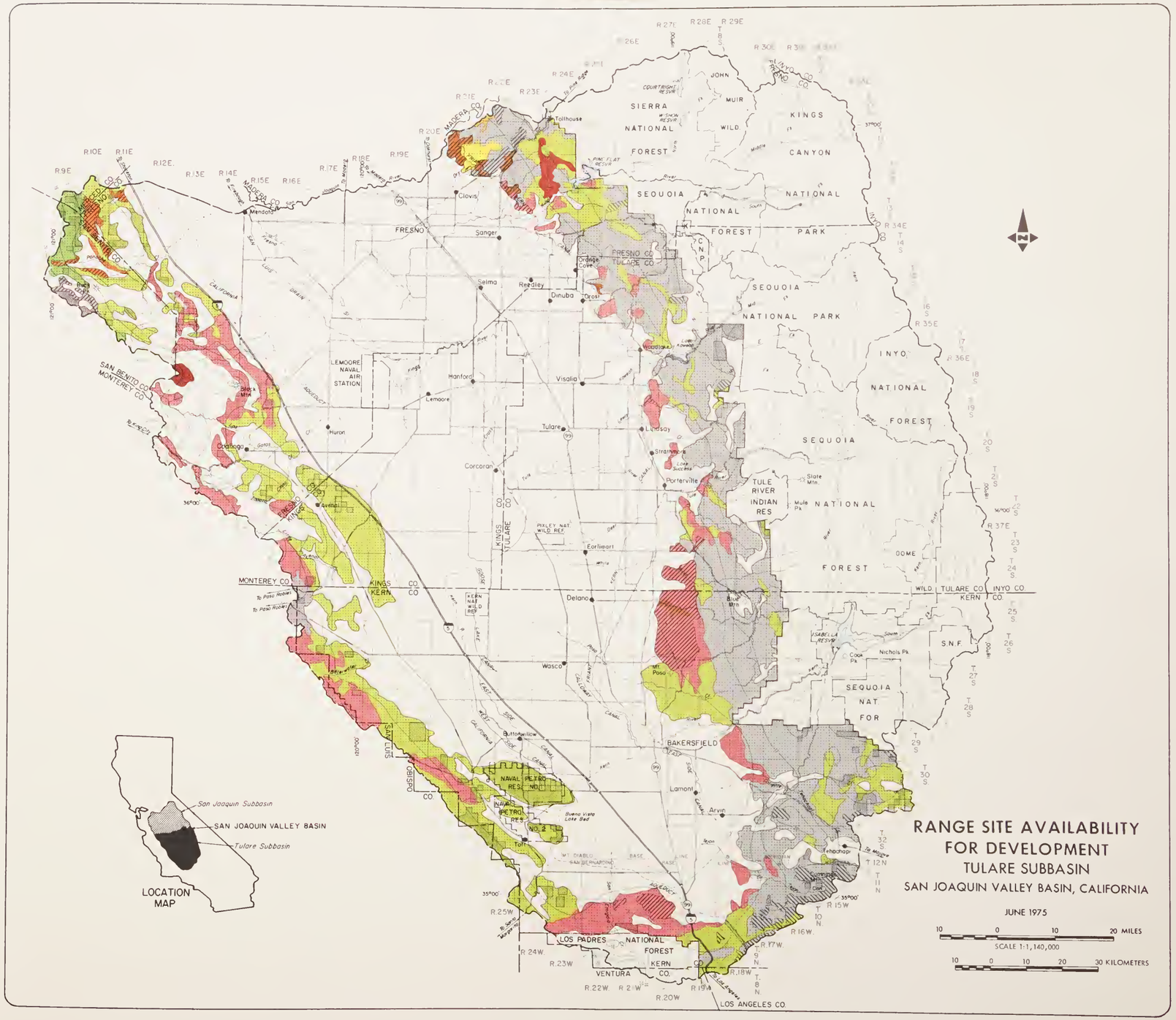
- Loamy
- Shallow Loamy
- Fine Loamy
- Shallow Coarse Loamy
- Very Shallow Loamy
- Clayey
- Claypan
- Terrace
- Serpentine
- Granitic
- Not Considered A Range Site

- Water
- National Forest Boundary
- Mean Annual Precipitation (Inches)

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carto Unit from California State Staff compilation.
Thematic detail compiled by California State Staff.

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE



RANGE SITE AVAILABILITY FOR DEVELOPMENT

TULARE SUBBASIN

SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES

SCALE 1:1,140,000

10 0 10 20 30 KILOMETERS

M7-SN-23490-9

chapter V resource problems

san joaquin valley basin study

PROPERLY MAINTAINED RANGE (LEFT) AND
OVER GRAZED RANGE (RIGHT)

chapter V resource problems

san joaquin valley basin study

The multiple use and management of water, land, capital, and labor together with wildlife, timber, recreation, rangeland, and agriculture have created complex inter-relationships and problems.

The California Region Comprehensive Framework Study (4) had identified the following land and water resource problems in the Basin:

Flooding	682,000 acres
Agricultural Drainage	330,000 acres
Agricultural Irrigation	2,150,000 acres
Erosion	382,000 acres
Average Annual Wildfire Losses	35,000 acres

Additional problems were identified during public meetings. All the problems are presented below grouped under *Water Management* or under *Land Management*.

FLOODING IN FRESNO, 1969

water management

FLOODING

Even though many major streams and rivers in the Basin are contained by dams, flooding is still a problem. There are two types of floods in the San Joaquin Valley Basin. General rainfall floods occur in late fall and winter in the foothills and on the valley floor. Snowmelt floods occur in late spring and early summer. Most floods have been produced by rainfall. Many of the problems are due to poor flood plain use, which results in costly damages.

Approximately 0.75 million acres in the San Joaquin subbasin and 1.5 million in the Tulare subbasin are prone to flooding. The Flood Prone Maps following page 60 indicate areas susceptible to flooding.

The most recent flood was in the spring and early summer of 1969. Estimates indicate the flood covered 650,000 acres and resulted in $86,208,000 in damages. Based on 1975 prices, a similar flood today would cost $143 million (Table V-1).

POOR DRAINAGE

Poor drainage is the most difficult and extensive of the valley's problems. In addition, drainage problems inevitably lead to salt build-up in the soil. Presently, the San Joaquin Valley Basin has a drainage problem encompassing almost two million acres (9).

TABLE V-1. FLOOD DAMAGES, SAN JOAQUIN VALLEY BASIN

	Forestry	Agriculture	Residential-Commercial	Industry-Utilities	Public Facilities	Total
			(Thousands of Dollars)			
San Joaquin Valley Basin						
1968-69 flood a	NA	82,442	15,962	6,741	37,612	142,757
1968-69 flood, 1973 conditions b	NA	62,670	13,854	6,696	32,509	115,729
100 year event, 1973 conditions c	23,605	95,032	69,271	19,494	40,956	248,358
Average annual damages	4,631	8,401	4,091	1,454	2,520	21,097
San Joaquin Subbasin						
1968-69 flood a	NA	25,988	2,406	131	8,042	36,567
1968-69 flood, 1973 conditions b	NA	6,216	298	86	2,939	9,539
100 year event, 1973 conditions c	1,635	12,202	20,600	4,606	7,124	46,167
Average annual damages	238	1,156	1,081	345	428	3,248
Tulare Subbasin						
1968-69 flood a	NA	56,454	13,556	6,610	29,570	106,190
1968-69 flood, 1973 conditions b	NA	56,454	13,556	6,610	29,570	106,190
100 year event, 1973 conditions c	21,970	82,830	48,671	14,888	33,832	202,191
Average annual damages	4,393	7,245	3,010	1,109	2,092	17,849

NA = Not Available

a Actual damages at the time of the flood updated to 1975 prices; or what the same flood would cost today. Source: U.S. Army Corps of Engineers, "Report of Floods, Central Valley of California, 1968-69 Flood Season"

b Estimated damages with the following dams in place: Los Banos, New Don Pedro, New Exchequer, Buchanan, Hidden, and New Melones. These dams control flooding in their area; the figures reflect damages in areas not controlled by these dams.

c No new dams were constructed between 1965-73 in the Tulare Subbasin, therefore, 1968-69 flood damages and 1973 conditions are the same.

Normally, water percolates down through the soil to the water table, carrying salts with it. However, a layer of rock, hardpan, or clay soil may restrict downward percolation of water. As a result, the water builds up above the restrictive layer, forming a water table.

All irrigation water contains a certain amount of salts. Salts accumulate in the soil as soil moisture evaporates or is transpired by plants. Usually, extra water is applied to leach the salts down through the soil, beyond the root zone. This extra water is referred to as the "leaching requirement".

When drainage is a problem, the water and salts can only move as far as the water table. In many cases, this means salts will still be in the root zone. If improved drainage is not provided, extra water applied for leaching will compound the problem by raising the water table.

Also, where a water table is present, capillary action in the soil will draw water upward, concentrating salts in the root zone and on the soil surface.

Poor quality irrigation water aggravates the problem, causing even higher salt concentrations. When irrigation supplies are taken from poor quality groundwater, as they are in much of the Basin, salt buildup is accelerated (18).

Poor drainage limits crop selection to shallow-rooted, salt tolerant crops. The "Drainage Problems" maps for San Joaquin and Tulare subbasins following page 60 present existing areas with poorly, partially, and potential drainage problems as well as areas with a drainage system. The maps were developed from information obtained from SCS Field Offices, Soil Surveys and Field Investigations (9).

For the purposes of this study, drainage conditions are defined as:

Poorly drained—Water table within five feet or less of the ground surface. The type of crop to be grown is restricted to water tolerant plant species. Their yields can be affected depending upon the depth to the water table.

Partially drained—Water table within five to ten feet of the ground surface during the growing season. Also included in this category are areas with drainage systems (drainage wells, open ditch drains, subsurface tile drains, etc.) where the system effectiveness has not been determined. The type of crop that can be grown is not affected, but yield may be affected.

Potential drainage problem—These are areas likely to experience drainage problems because of their soil characteristics or physiographic location.

TABLE V-2. CHANGES IN GROSS DRAINAGE CONDITIONS, SAN JOAQUIN VALLEY BASIN [a]

	1975 (Acres)	2000 (Acres)	Change (Acres)
Poorly Drained	741,000	1,977,000	+1,236,000
Partially Drained	1,251,000	797,000	-454,000
Potential Problem	2,449,000	1,667,000	-782,000
TOTAL	4,441,000	4,441,000	0

a This table shows the total drainage problem without regard to land-use. Therefore, it includes drainage problems which occur on presently irrigated cropland and pastureland, rangeland, urban-industrial land, farmsteads, roads and land devoted to wildlife uses.

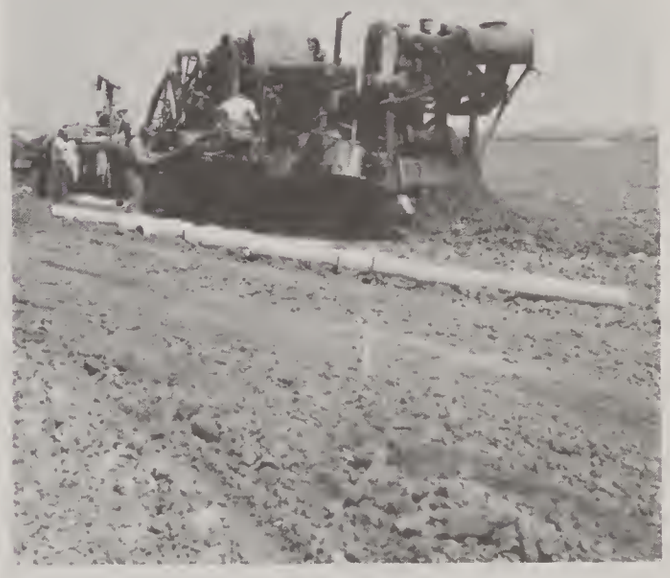
A significant portion of the Basin is affected by drainage problems, especially on the west side and in the trough. See Drainage Problem Map following page 60. The drainage problem area is increasing (Table V-2). The progression of land from partially drained to poorly drained puts severe limitations on its use. Currently, about 0.75 million acres of land can be classed as poorly drained. This is expected to increase to nearly two million acres by 2000. There is a steady deterioration from potential problem area to partially drained condition.

IRRIGATION WATER

Irrigation and drainage problems are closely related. Three of the most pressing irrigation problems are boron concentration, groundwater quality and on-farm irrigation efficiency. Overdraft of the groundwater basin is also a problem.

Boron is a naturally occurring salt in both soil and groundwater. Normally, boron is just a trace element. However, 193,700 acres in the San Joaquin subbasin and 569,000 acres in the Tulare subbasin have boron concentrations greater than 2 ppm within the soil. This problem is primarily on the western side of the Basin. See Irrigation Problems Map following page 60.

High boron concentrations affect plant growth. Many crops show reduced yields when boron concentrations reach 1-2 ppm. Excess boron also contributes to low groundwater quality.



LIMA BEANS WITH WATER TABLE AT 3 FEET, SUMMER OF 1968

INSTALLING DRAIN LINES ON SAME FIELD, FALL OF 1968

LIMA BEANS AFTER TILE DRAINAGE INSTALLED AND WATER TABLE LOWERED TO 6 FEET, FALL OF 1969

Low quality groundwater is found throughout much of the San Joaquin Valley Basin. The quality of groundwater is determined primarily by salt concentrations. Groundwater salinity is a problem for 550,000 acres in the San Joaquin subbasin and 760 acres in the Tulare subbasin.

Agriculture in the Basin derives approximately 46 percent of its water from groundwater supplies. Therefore, the quality of the groundwater becomes important to crop selection and production. Many crops are sensitive to high concentrations of salt. In addition, salt present in the irrigation water means more water must be applied to allow for leaching. This contributes to drainage problems.

Irrigation efficiency is another problem. Low, on-farm irrigation efficiencies mean more water is being applied than plants use. In cases where salt concentrations are high, more water must be applied than the plant uses to allow for leaching (refer to section on drainage problems). Present average on-farm efficiencies are 60 percent in the San Joaquin subbasin and 67 percent in the Tulare subbasin. Significant areas have low on-farm efficiencies (below 60 percent); 44,700 acres are in the San Joaquin subbasin and 805,000 acres in the Tulare subbasin. See Irrigation Problems Maps following page 60. However, the Basin efficiency is much higher and amounts to about 73 percent for the San Joaquin subbasin and 96 percent for the Tulare subbasin because of the reuse of return flows downstream.

land management

OUTDOOR RECREATION

Increasing leisure time for most Californians and the proximity of the Basin to Los Angeles and the San Francisco Bay Area contribute to recreation use in the Basin. More than fifty percent of the recreation users are from metropolitan areas outside the Basin.

There are numerous popular recreation pursuits in the San Joaquin Valley Basin, including pleasure driving, walking, hiking, hunting, fishing, swimming, sightseeing, picnicking, camping and others.

The current and projected supply of non-urban recreation facilities is sufficient for expected future demand with the exception of developed campsites. The supply of developed campsites is not expected to keep pace with projected demand.

TIMBER PRODUCTION

The future demand for San Joaquin Valley Basin timber is expected to exceed future timber production.

Timber harvests now average 80 million cubic feet per year. Annual harvests are expected to remain nearly constant through the year 2000. Demand, however, is expected to increase to 100 million cubic feet by the year 2000.

The timberlands of the Basin have the capability to meet projected demand. Projected production is less than capability because intensive management is not practiced on most of the timberlands. Much of the timberland is understocked or is stocked with over-mature trees that are no longer growing rapidly.

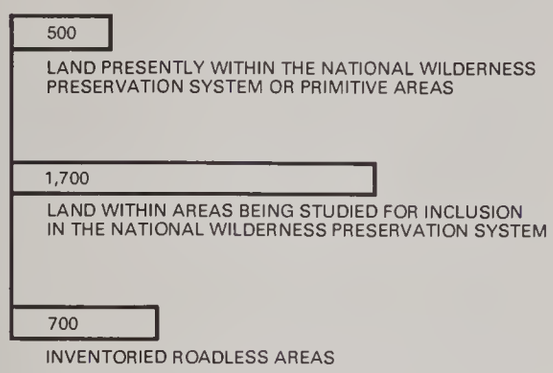
WILDERNESS PRESERVATION

The desire to retain wilderness areas has become more pronounced in recent years. Some people want areas where they can hike or backpack without human contact. Others may never see a wilderness area, but just want to know it's there.

Through public hearings and input into environmental statements, organized groups such as the Sierra Club, Wilderness Society and others have expressed the desire to preserve nearly all lands having wilderness characteristics. According to existing U.S. Forest Service and National Park Service inventories (Figure V-1), there are about 2.9 million acres of this land in the Basin.

FIGURE V-1. CURRENT WILDERNESS INVENTORY, SAN JOAQUIN VALLEY BASIN

(Thousands of Acres)



Source:
San Joaquin Planning Area Guide, Forest Service, USDA, and Synopsis of Formal Classification Actions and Listings of Designated Areas, Forest Service, USDA.

About 0.5 million acres of this land is currently within the National Wilderness Preservation System or existing Primitive Areas. An additional 1.4 million acres of National Park and 300,000 acres of National Forest are being studied for inclusion in the National Wilderness Preservation System. Another 0.7 million acres of roadless area have been inventoried and may be managed for preservation of wilderness values as a result of the ongoing National Forest planning programs. These inventories are now being updated during the second Roadless Area Review and Evaluation (RARE II).

RANGE FORAGE

The poor range conditions in the Basin severely reduce the amount of forage produced (expressed in animal unit months). Currently, the Basin's range produces 2,650,000 animal unit months (AUM's) of grazing. This translates to 132,157,000 pounds of animal gain annually, and represents only 57 percent of the natural potential production.

A significant portion of the Basin's rangeland has problems. Of the four million acres of private rangeland, 3.2 million acres, or 80 percent has problems. In the San Joaquin subbasin, 88 percent of the range is affected; and in the Tulare subbasin, 74 percent has problems.

Many of the range problems in the Basin can be traced to ineffective management techniques. Overgrazing and/or low soil fertility cause a loss of plant cover. This leads to erosion, loss of watershed values, and a decrease in forage productivity. Sediment from rangeland can also contribute to water quality problems and affect the productivity of land downstream.

For the purposes of this study, seven rangeland problems are described; five of them represent progressively deteriorating conditions (Table V-3). The problems vary from a fairly simple overgrazing problem, which is easily corrected, to range which has been almost completely invaded by brush and is essentially useless for livestock grazing.

Recreational uses can also curtail the productivity of range. Off-road vehicles and other recreational pursuits destroy vegetative cover and accelerate erosion. In some cases, use of range is restricted because of the proximity of rural and second home subdivisions.

Overgrazing seriously reduces the value of rangeland habitat for most wildlife and usually has a serious impact on threatened species of plants and animals. In some cases, the Basin's rangeland provides the last remaining habitat for certain endangered species.

TABLE V-3. RANGE FORAGE PROBLEMS, SAN JOAQUIN VALLEY BASIN, 1972

PROBLEM CONDITION	PRIVATE LAND (Acres)	NATIONAL FOREST LAND (Acres)	BASIN TOTAL (Acres)
1 Forage production adequate. Desired vegetation present. Plant cover poor at end of season.	1,341,000	51,000	1,392,000
2 Forage production low. Desired vegetation present but poor growth. Low soil fertility.	538,000	15,000	553,000
3 Forage production low. Desired vegetation present. Low fertility. Encroachment.	257,000	a	257,000
4 Forage production low. Desired vegetation can not revegetate. Low fertility.	112,000	6,000	118,000
5 Forage production very low. Woody and noxious plants replacing desired species.	190,000	30,000	220,000
6 Loss of wildlife habitat.	371,000	—	371,000
7 Recreation overuse.	521,000	—	521,000
TOTAL PROBLEM AREA	3,330,000	102,000	3,432,000
Rangeland without problems	653,000	497,000	1,150,000
National Resource Lands (not analysed)	—	—	400,000
TOTAL RANGELAND	3,983,000	599,000	4,982,000

a Acreage shown in Problem 5.

RANGELAND EXCELLENT CONDITION (LEFT) AND POOR CONDITION (RIGHT)

EROSION AND SEDIMENTATION

Over two million acres of Basin land are affected by moderate to severe erosion problems Generally, sheet and gully erosion affect the foothills and mountains, and wind erosion affects the flat, valley portion (Table V-4).

The flat portions of the Basin are also the agricultural areas. Fields that are left bare or are in the stage between seedbed preparation and crop establishment are the most susceptible to wind erosion. Approximately 182,000 acres are affected by this problem.

Seedlings can be severely damaged by wind erosion, making it necessary to replant entire fields. This results in a shorter growing season and reduces yields 10 to 20 percent. Estimated cost due to this type of damage is $8.65 million annually.

The sediment yield from the valley is relatively low. However, since the agricultural land often lacks cover, some sediment is produced during heavy rains.

In the foothills and mountains, sheet and gully erosion are the major problems. Although rainfall is higher on the east side of the Basin than on the west, the sediment yield for the two areas is about the same. This is due to the fact that soils in the Sierras are much more resistant to weathering than those in the Coast or Tehachapi mountains. Also, cover on range and forestland is generally better in the Sierras.

In these areas, range is the most affected by erosion. Sheet and gully erosion decrease forage production by removing seeds, topsoil and nutrients. Estimates by the USDA staff indicate that erosion reduces forage production by five percent of its potential. Translated to dollars, this means an annual loss of $1,172,900.

Streambank erosion is a major source of sediment. Approximately 800 miles of streams have moderate to severe erosion.

In the upper watersheds, individual streams produce small amounts of sediment. Collectively they yield large quantities because of their numbers. Downstream, there are fewer streams, they are larger, and the gradients are flatter. These are bordered by terraces and alluvial areas which are easily eroded. Sediment yield is higher on these streams.

Sedimentation has a number of repercussions. The capacity of streams, channels and reservoirs is reduced which causes flooding. Floods destroy cropland and deposit sediments and other debris which are expensive to remove. Sediment also destroys fish spawning by covering gravel beds.

Sediment yields in different portions of the Basin are shown on Sediment Yield Maps following page 60.

Average sediment yield was determined for five broadly defined areas in the San Joaquin Valley Basin. The average yields were determined from reservoir sediment surveys, suspended sediment gauging stations, estimates made for project areas and application of the Universal Soil Loss Equation to certain areas. From west to east, these broadly defined areas and their estimated average sediment yields in acre feet per square mile per year are listed in Table V-5.

TABLE V-4. EROSION STATUS, SAN JOAQUIN VALLEY BASIN, 1975

Moderate — Severe Wind erosion	182,000 acres
Moderate — Severe Sheet/Gully erosion	2,167,000 acres
Moderate — Severe Streambank erosion	800 miles
Deposition of sediment by water	398,000 acres

TABLE V-5. ESTIMATED SEDIMENT YIELDS, SAN JOAQUIN VALLEY BASIN

	Average Yield	Expected Range in Yield
	(Acre Feet per Square Mile per Year)	
Coast Range and Tehachapi Mountains	0.30	0.20-0.50
West Side Fans	0.15	0.10-0.20
Central Valley	0.05	0.00-0.10
East Side Fans	0.20	0.10-0.20
Sierra Nevada Mountains	0.25	0.10-0.30

Cover conditions and high intensity rainfall are the predominant factors causing the high sediment yields from the eastern slopes of the Coast Range and the northern slopes of the Tehachapi Mountains. Pasture is the major land use in this part of the Basin. The pasture is in fair condition although many bare areas are present.

The west and east side alluvial fans have like soils, slope and cover. These areas have about the same range of sediment yields. Since average yearly rainfall is greater on the east side, sediment yield should be estimated on the high side of the sediment yield range shown above and on the map.

In relation to the Coast Range, the Sierras have slightly less erosive soils, moderate to good pasture and forest cover, steep slopes, but resistant rocks and relatively high rainfall. Good cover and more resistant rocks appear to be the predominant factors in lower sediment yields from the Sierras.

The Central Valley with its flat slopes and leveled fields has a very low sediment yield. Because agricultural land frequently lacks cover and is the major land use of this area, some sediment is produced during high intensity rainfall.

EROSION IN ORCHARD

COLD, CLEAR WATERS PRODUCE TROUT FOR FOOD AND RECREATION

FISH AND WILDLIFE

In general, fish and wildlife problems are habitat related problems. Rare and endangered species, along with many others are affected by habitat alterations caused by changing land use patterns (5, 10).

Fish

Fluctuations in water flow in the San Joaquin River as well as other rivers and streams cause many of the fish related problems.

In most cases, freshwater fish need specific salinity gradients, flow conditions, water temperatures, spawning gravels, open migration routes, and other requirements to make successful upstream migrations. Water diversions and reverse flows in the San Joaquin River can affect these necessary components, reducing successful spawning and making it difficult for salmon to find their home stream. The lack of water releases from July to September result in a loss of spawning gravels through encroachment of aquatic vegetation.

Water manipulation also affects fresh water fish. Low flows in streams affect water temperature and dissolved oxygen content. In addition, reservoirs holding irrigation water usually have seasonally fluctuating water levels, which adversely affect fisheries.

Insufficient water flows and high temperatures are the major problems for cold water fish. In addition, alteration of stream channels and other water projects disturb the riffle-pool balance so important to trout.

Deer Habitat

Declining deer habitat is an important wildlife problem. The 6.9 million acres of deer habitat is declining rapidly primarily because of expansion of intensive agriculture and urbanization. Habitat that is available is often poor quality.

Other Wildlife Habitat

There are fourteen major habitat types in the San Joaquin Valley Basin, some of these provide more wildlife habitat than others, and some habitat types are more threatened than others (10) (Table IV-7).

Of particular concern is the loss of riparian habitat. This habitat occurs along stream and slough banks. The area covered by riparian vegetation is small, but its importance to wildlife is large. The State of California has identified this habitat as a resource of statewide concern (16). A number of factors are responsible for loss of riparian habitat. Among the more important are stream channelization for water conservation or flood control and construction of upstream reservoirs.

Another important habitat type is wetlands. Some of the major waterfowl wintering areas on the Pacific Flyway are located in the San Joaquin Valley Basin. Reclaiming of wetlands for agricultural, residential and industrial use will encroach on habitat for waterfowl and many other kinds of animals.

Land use patterns are also of major concern to wildlife. Urban, industrial, and intensive agricultural land uses often exclude wildlife. Modern farming and forestry techniques remove shrubs and brush used by wildlife for food and cover. One exception is the ring necked pheasant, which lives almost entirely within agricultural areas. However, as more land is converted to irrigated agriculture increasing pheasant habitat, the quality of the habitat declines due to more intensive cultivation practices such as clean tillage etc.

WILDFIRE DESTRUCTION

WILDFIRES

Range and forest fires burn an average of 35,000 acres annually. Wildfires curtail production, and destroy recreation areas, wildlife habitat, and watershed values. Damages are often substantial.

Fires have been evaluated by vegetation type and total acreage by size. In both cases the distribution is disproportionate. While small fires have the greatest number of starts, they do not account for the most acreage. In other words, one large fire is more damaging than many small fires. Therefore, the major fire problem is combatting the infrequent, large fire that does nearly 90 percent of the fire damage in the San Joaquin Valley Basin.

Most of the fire damage occurs in lower elevation foothill areas because brush, grass, and mixed woodland-grass types are more susceptible to fire. Because of warmer summers, poor road access and less precipitation, brush and grass fires are more difficult to control than higher elevation timber fires (Figure V-2).

Although lightning starts over 14 percent of the fires, it is responsible for only 10 percent of the total acreage burned. The remainder of the fires are man-caused. They are often the result of negligence. Arson accounts for approximately 18 percent of the fire starts and causes 45 percent of the total acreage damage (Figure V-3).

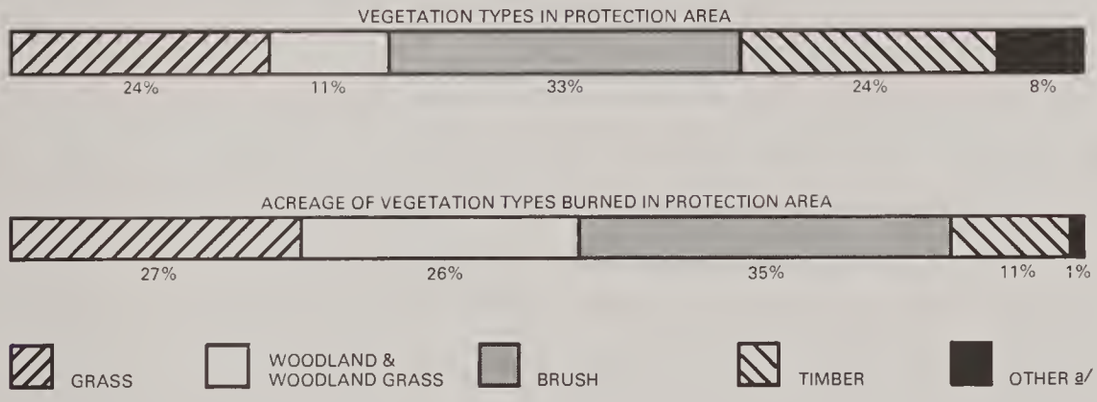
AIR POLLUTION

The geography and meterology of the San Joaquin Valley Basin is conducive to air pollution since it is closed on three sides.

A number of factors contribute to the pollution in the Basin. Some of the air pollution is probably generated outside the Basin in the San Francisco Bay Area. Once inside the Basin, the pollutants become trapped. Sources within the valley include automobiles, industry, and agriculture. Automobile exhaust and agricultural burning are the largest single contributors. Ozone (O_3) is the most damaging air pollutant. The western foothills and mid-eastern slopes of the Sierra Nevada in the 1976 growing season received a greater exposure to ozone than any other place in the Basin.

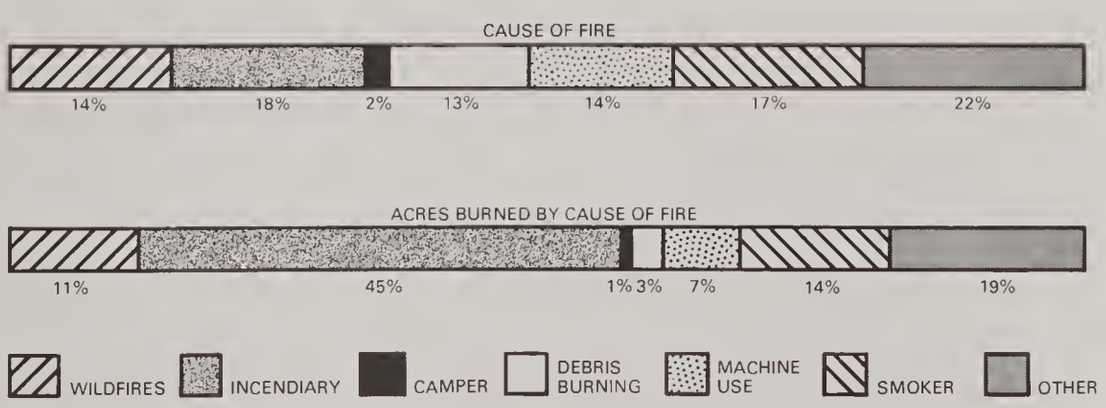
Particularly important to the Basin is the effect of air pollution on crop and tree species. Different types of air pollution affect different crops. Crops sensitive to one or more air pollutants include: alfalfa, barley, wheat, corn, grapes, peaches, tomatoes, and beans. At present there is not enough information to quantify the losses due to pollution but they are estimated to be in the millions of dollars. Air pollutants have proved damaging to four forest tree species: Ponderosa pine, jeffrey pine, monterey pine, and big cone douglas fir. Both ponderosa and jeffrey pine are commercially important species. Four other species injured to a lesser degree include white fir, sugar pine, incense cedar, and black oak. Of these, the first three are commercially important.

FIGURE V-2. WILDFIRE PROTECTION AREA AND ACRES BURNED BY VEGETATION, SAN JOAQUIN VALLEY BASIN, 1961 - 1970 AVERAGE



a/ Includes small scattered acreages of minor tree species, barren and cultivated land.

FIGURE V-3. PERCENT OF FIRES AND ACRES BURNED BY CAUSE OF FIRE, SAN JOAQUIN VALLEY BASIN, 1961 - 1970 AVERAGE



Source: Data from California Department of Forestry.

ANNUAL SEDIMENT YIELD

	AVERAGE SEDIMENT YIELD AC.FT./SQ.MI./YR.	DRAINAGE AREA SQ. MILES
RESERVOIR SEDIMENT SURVEYS		
(1) Lyons Reservoir- South Fork Stanislaus River	0.10	40.0
(2) Don Pedro Reservoir- Tuolumne River	0.21	1001.0
(3) Lake McClure- Merced River	0.17	1027.0
(4) Bass Lake- Tributary of San Joaquin River	0.16	54.5
(5) Kerckhoff Lake- San Joaquin River	0.18	1530.0
SUSPENDED SEDIMENT GAGING STATIONS		
11 - 2628.00 - Los Banos Creek	0.01	159.0
11 - 2645.00 - Merced River	0.01	181.0
ESTIMATES MADE FOR PROJECT AREAS		
A Mustang Creek	0.15	11.5
COAST RANGE	0.30	
WEST SIDE FANS	0.15	
VALLEY	0.05	
EAST SIDE FANS	0.20	
SIERRAS	0.20	
MAJOR WATERSHED BOUNDARY		
MINOR WATERSHED BOUNDARY		

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Cartog. Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.

ANNUAL SEDIMENT YIELD
SAN JOAQUIN SUBBASIN
SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

M7-SN-23488-7

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

ANNUAL SEDIMENT YIELD

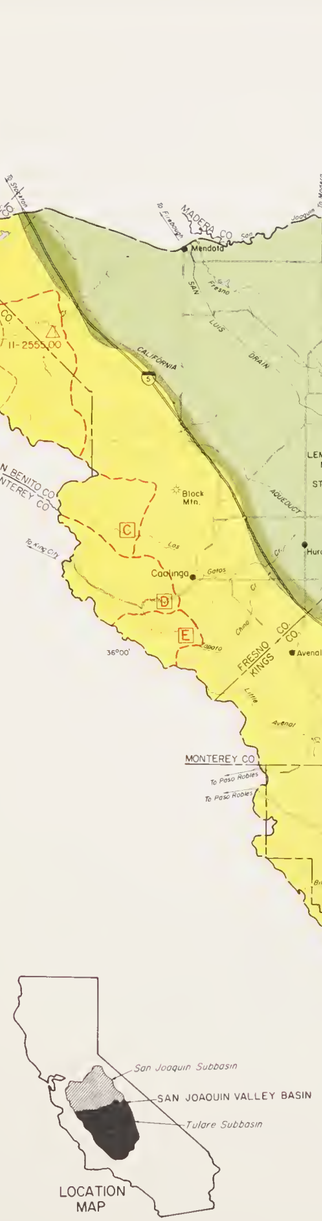
	AVERAGE SEDIMENT YIELD AC.FT./SQ.MI./YR.	DRAINAGE AREA SQ. MILES
RESERVOIR SEDIMENT SURVEYS		
6 Teakettle Reservoir – Tributary to N.Fk. Kings River	0.02	3.6
7 Pine Flot Reservoir – Kings River	0.20	1542.0
8 Hume Lake – Upper Kings River	0.03	24.2
9 Lake Success – Tule River	0.64	393.0
10 Lake Kaweah – Kaweah River	0.75	560.0
11 Lake Isabella – Kern River	0.16	2074.0
SUSPENDED SEDIMENT GAGING STATIONS		
11 - 2555.00 - Panoche Creek (lower)	0.13	293.0
11 - 2087.30 - East Fork Kaweah River	0.18	85.0
11 - 1870.00 - Kern River	0.40	1009.0
ESTIMATES MADE FOR PROJECT AREAS		
B Panache Creek (upper)	0.30	150.0
C Las Gatas Creek	0.20	98.0
D Warthan Creek	0.40	113.0
E Jacalitos Creek	0.30	50.0
F Tehachapi Creek	0.40	288.0
COAST RANGE / TEHACHAPI MTNS.	0.30	
WEST SIDE FANS	0.15	
VALLEY	0.05	
EAST SIDE FANS	0.20	
SIERRAS	0.30	

MAJOR WATERSHED BOUNDARY

MINOR WATERSHED BOUNDARY

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carto. Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.



ANNUAL SEDIMENT YIELD

TULARE SUBBASIN

SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES

SCALE 1:1,140,000

10 0 10 20 30 KILOMETERS

M7-SN-23490-7

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA SCS PORTLAND OR 1975

LEGEND

Flood Prone Areas

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Corto. Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.

FLOOD PRONE AREAS

SAN JOAQUIN SUBBASIN

SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES

SCALE 1:1,140,000

10 0 10 20 30 KILOMETERS

M7-SN-23488-5

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

LEGEND

Flood Prone Areas

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carto. Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.

FLOOD PRONE AREAS
TULARE SUBBASIN
SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE SCS PORTLAND OR 1975

M7-SN-23490-5

LEGEND

Poorly drained-water toble within 5 feet or less of the ground surfoce .

Portiolly droined-woter table between 5 ond 10 feet of ground surfoce during the growing seoson.

Areo with a drainoge system-woter toble between 5 ond 10 feet of ground surfoce with some type of droinoge system (droinoge wells, open ditch drains, subsurfoce tile droinoge systems, etc.). System effectiveness not determined. Assumed to be partially drained.

Potential drainage problem oreo under present trends because of soil choracteristics or physiographic locotion.

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Corta Unit from California State Staff compilation.
Thematic detail compiled by California State Staff.

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

DRAINAGE PROBLEM AREAS
SAN JOAQUIN SUBBASIN
SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

M7-SN-23488-1

LEGEND

Paarly drained-water table within 5 feet ar less of the ground surface.

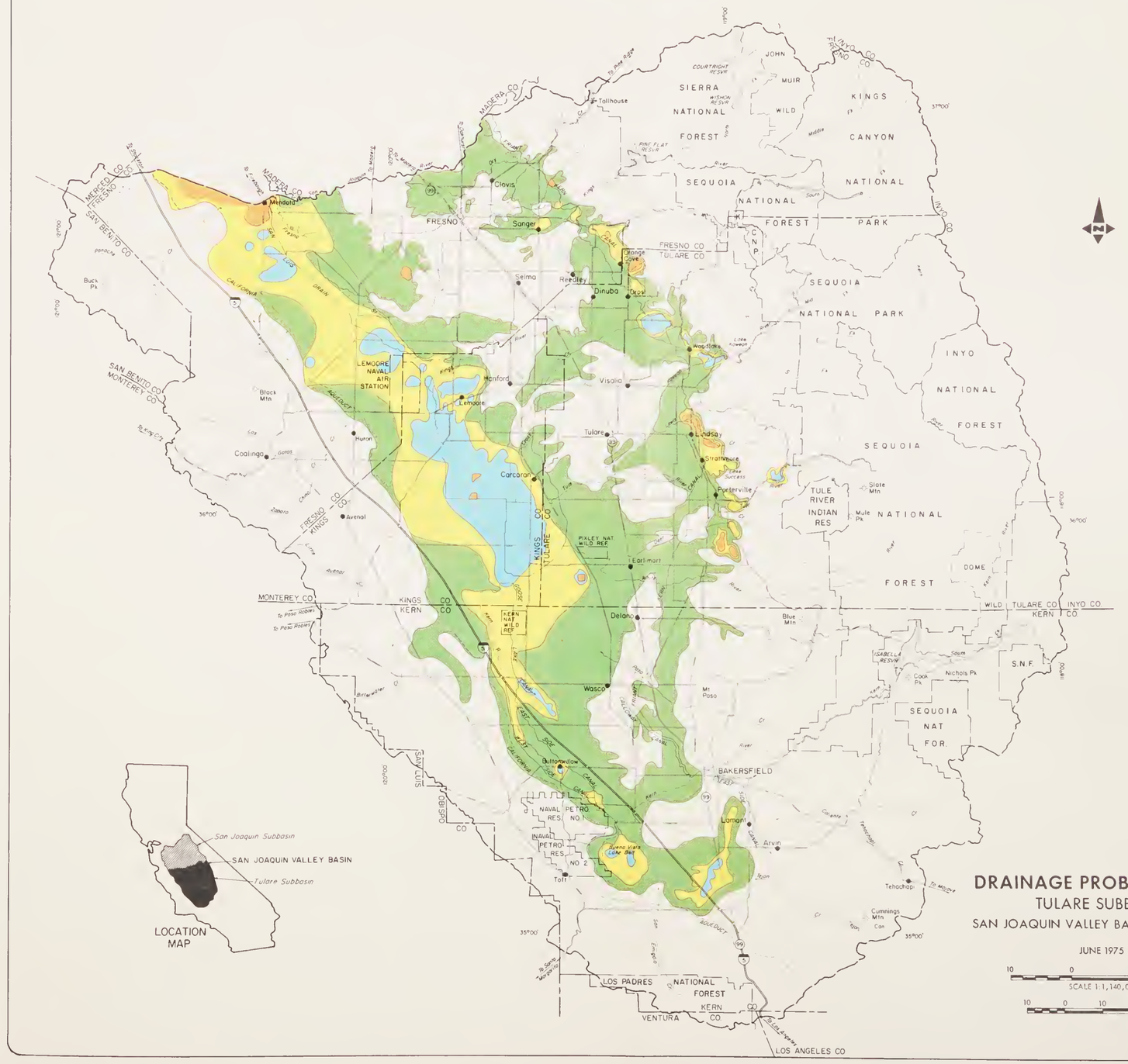
Partially drained-water table between 5 and 10 feet of ground surface during the growing seasan.

Area with a drainage system-water table between 5 and 10 feet of ground surface with some type of drainage system (drainage wells, apen ditch drains, subsurface tile drainage systems, etc.). System effectiveness not determined. Assumed ta be partially drained.

Patential drainage problem area under present trends because of soil characteristics or physiographic location.

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carta Unit from California State Staff compilation.
Thematic detail compiled by California State Staff.



DRAINAGE PROBLEM AREAS
TULARE SUBBASIN
SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA SCS PORTLAND, OR 1976

M7-SN-23490-1

IRRIGATION PROBLEMS

Ground Water Quality Greater Than 1000 Parts Per Million - Total Dissolved Solids

Irrigation Application Efficiency Less Than 60%

Boron Greater Than 2 Parts Per Million

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carto Unit from California State Staff compilation.
Thematic detail compiled by California State Staff.

IRRIGATION PROBLEMS
SAN JOAQUIN SUBBASIN
SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

M7-SN-23488-4

U.S. DEPARTMENT OF AGRICULTURE · SOIL CONSERVATION SERVICE USDA-SCS PORTLAND OR-1976

IRRIGATION PROBLEMS

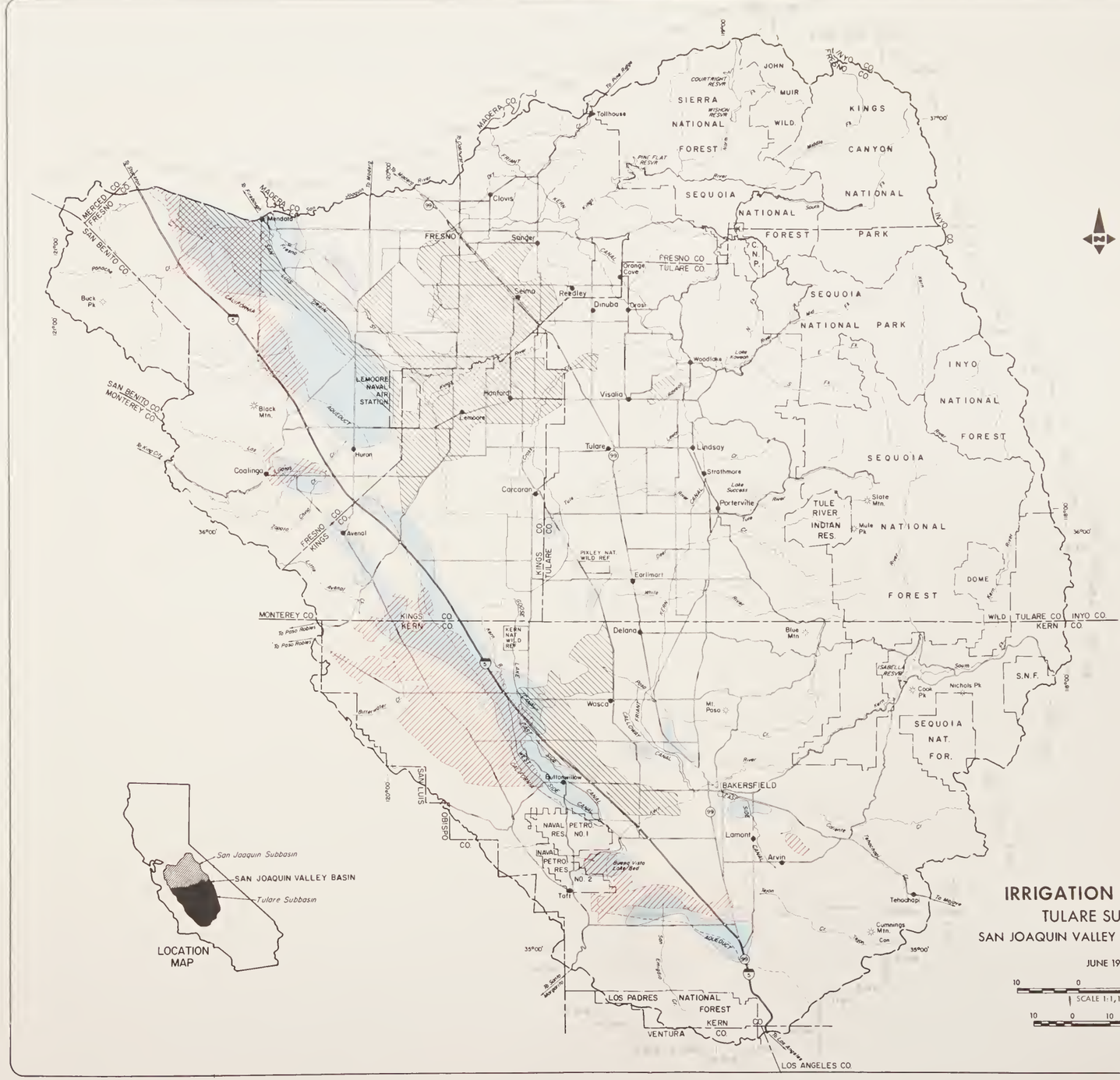
Ground water quality greater than 1000 parts per million – total dissolved solids.

Irrigation application efficiency less than 60%.

Boron greater than 2 parts per million.

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carto. Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.



IRRIGATION PROBLEMS
TULARE SUBBASIN
SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES
SCALE 1:1,140,000
10 0 10 20 30 KILOMETERS

chapter VI economics
san joaquin valley basin study

RANGELAND IMPROVED BY FERTILIZING

chapter VI economics

san joaquin valley basin study

Economic development in California was slow until the gold rush. Then, in one year, the population increased tenfold. Since then, population has doubled every 20 years. After World War I, manufacturing became increasingly important in the state. However, in both the Basin and the state as a whole, agriculture is still the largest industry in terms of gross value of output.

Today the Basin comprises 47 percent of the state's farmland, and produces 44 percent of the state's agricultural products sold. Nationally the Basin accounts for 1 percent of the Nation's area in farms but produces 4.4 percent of the Nation's gross output of agricultural products. The three highest ranking counties in the Nation in terms of agricultural products sold are in the Basin: Fresno, Tulare and Kern. In addition, Stanislaus, San Joaquin, Merced and Kings Counties rank among the top twenty agricultural counties in the Nation (3).

EMPLOYMENT

Agriculture provides 27.4 percent of the Basin's jobs. This is in sharp contrast to the 4.6 percent figure for the state. On the other hand, employment in manufacturing is considerably lower for the state (Figure VI-1).

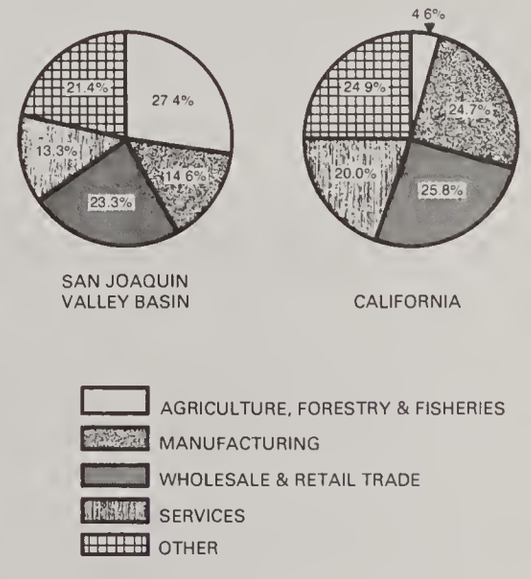
Total employment in the Basin is now 530,000 people, or 6.5 percent of the state's labor force.

INCOME

Total income for both the Basin and the state has increased substantially between 1955 and 1970. State income has increased faster than the income in the Basin due to the development of urban economies not prevalent in the Basin.

Per capita income for Basin residents is lower than for the state population as a whole. In 1970 income per person in the Basin was $3,156 while the average for all of California was $3,935 per person. Average income per worker in the Basin is $7,954 compared to a state average of $9,452 (1967 constant dollars). This reflects the more agriculturally oriented economy in he Basin relative to the state.

FIGURE VI-1. EMPLOYMENT DISTRIBUTION, AVERAGE MONTHLY EMPLOYMENT, SAN JOAQUIN VALLEY BASIN, 1973



URBAN ECONOMY

The San Joaquin Valley Basin has three urban centers: Fresno, Bakersfield, and Modesto. These are the centers for buying, processing and distributing the agricultural products of the Basin. These centers are rapidly taking on the characteristics of urban economies due, in large part, to the demands of an agribusiness economy producing the food, fiber and energy for the Nation.

TRANSPORTATION

The Basin's cities are centers for transporting goods to other parts of the state and Nation. As a result, an extensive transportation system has developed. The Basin has two major railroads, two major interstate highways, air service, and access to a deepwater port at Stockton.

The transportation systems are in turn affecting the Basin's economy. For instance, the opening of Interstate 5 has led to a considerable increase in the number of restaurants, gas stations, and other service enterprises on the west side of the Basin.

TABLE VI-1. CROP PRODUCTION COMPARISONS, SAN JOAQUIN VALLEY BASIN, 1970-1972 AVERAGE

CROP	CALIFORNIA PRODUCTION	SHARE OF STATE PRODUCED IN SAN JOAQUIN VALLEY BASIN
Fruits and Nuts	(1,000 Tons)	
Grapes	2,854	81%
Almonds	128	60%
Citrus	2,302	36%
Deciduous	2,084	47%
Walnuts	210	50%
Olives	54	92%
Figs	44	52%
Subtotal	7,676	57%
Vegetables		
Tomatoes	4,244	37%
Potatoes	1,306	54%
Melons	633	50%
Green beans	68	45%
Lettuce	1,649	4%
Other vegetables	898	44%
Subtotal	8,798	34%
Field Crops		
Cotton	323	94%
Barley and wheat	2,084	73%
Alfalfa hay	6,845	66%
Sugarbeets	8,530	35%
Sorghum grain	559	65%
Silage	4,000	91%
Corn grain	606	47%
Safflower	209	48%
Alfalfa seed	22	92%
Dry beans	121	58%
Rice	916	9%
Subtotal	24,215	58%

AGRICULTURAL ECONOMY

Agriculture is the foundation of the Basin's economy; it provides 27 percent of the jobs, stimulates support industries, and accounts for most of the land use. In the Basin, 58 percent of the land is in farms. This is considerably higher than the state figure of 36 percent or the national figure of 47 percent.

Farm Size

There is a definite polarization of Basin farms. On one hand, large commercial farming operations are decreasing in number but are growing in size. Between 1959-69 there was an 8 percent decrease in number of farms. At the same time average farm size increased from 269 acres to 304 acres in the San Joaquin subbasin (13 percent increase) and from 437 to 502 in the Tulare subbasin (15 percent increase). On the other hand, there are a growing number of small and part-time commercial farms. Between 1964-69 the number of farms less than 50 acres went from 13,622 to 14,607 (7 percent increase). There are a number of possible reasons for the increase in small farms. Urban buyers may be purchasing land as an investment. The move to "get back to nature" may be affecting this trend. Third, there is a 160-acre limitation to receive Federal water deliveries.

There are several reasons that may continue the trend to larger commercial farms. Increased wage rates have forced capital substitution for labor. Increased specialization in crop production creates added demand for land control and results in increased farm size by outright ownership or interlocking lease arrangements. Economies of scale evidently have not reached maximum and place further demands to increase farm size. The desire to bring other family members into the business in combination with the above also places pressures to increase farm size.

Crop Production

There are three major crop groups grown in the Basin: fruits and nuts; vegetables; and field crops. Field crops occupy 72 percent of the Basin's agricultural land; fruits and nuts use 23 percent; and vegetables 5 percent.

Between 1970-72, Basin farms produced 57 percent of the State's fruit and nuts; 34 percent of the vegetables and 58 percent of the field crops. Basin farms produce more than 50 percent of the State's output of grapes, almonds, walnuts, olives, figs, potatoes, melons, cotton, barley and wheat, alfalfa hay, sorghum grain, silage, alfalfa seed and dry beans (Table VI-1).

This crop production results in substantial revenues for the Basin. Total return for the 24 most important crops is almost $1.7 billion annually (Table VI-2).

TABLE VI-2. VALUE OF CROP PRODUCTION, SAN JOAQUIN VALLEY BASIN, 1970-1972 AVERAGE

CROP	SAN JOAQUIN VALLEY BASIN
	(Millions of Dollars)
Fruits and Nuts	644.9
Vegetables	206.1
Field Crops	809.0
TOTAL	1660.0

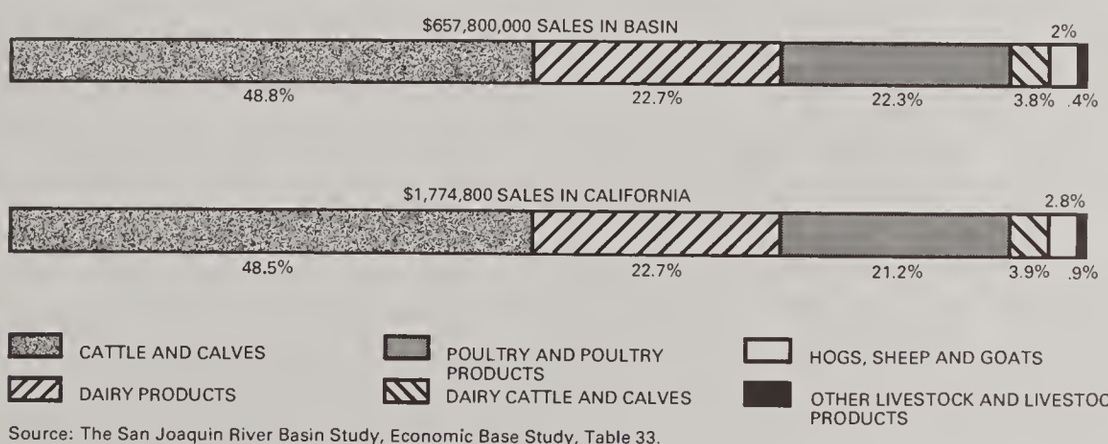
IRRIGATED PASTURE

Livestock Production

In both the Basin and the state the value of livestock sales is lower than the value of crop sales. Nationally the trend is reversed. In 1969, livestock sales totalled approximately $3.88 billion; 38 percent of the state total. Of this revenue, cattle and calves (including feeder cattle and feedlot cattle) accounted for 48 percent, dairy products were second with 23 percent, and poultry was 22 percent of the Basin total (Figure VI-2).

Within the Basin, the Tulare subbasin far outranks the San Joaquin subbasin in livestock production. The Tulare subbasin accounts for 69 percent of the Basin's livestock sales (Figure VI-2).

FIGURE VI-2. LIVESTOCK SALES BY COMMERCIAL FARMS, SAN JOAQUIN VALLEY BASIN AND CALIFORNIA, 1975



Source: The San Joaquin River Basin Study, Economic Base Study, Table 33.

TIMBER PRODUCTION

About 80 million cubic feet of timber is harvested annually from the Basin's 1.6 million acres of timberland. Annual stumpage revenues to forest landowners average about $50 million. The Basin's timber products industry includes 27 mills and employs more than 4,500 people in timber harvesting and the manufacture of wood and paper products (Table VI-3).

TABLE VI-3. FOREST PRODUCTS INDUSTRY CHARACTERISTICS, SAN JOAQUIN VALLEY BASIN

Number of Mills by Type a	Number of Mills
Lumber	24
Veneer and Plywood	1
Pulp and Board	1
Post, Pole and Piling	1
Wage and Salary Employment by Industry b	**Number of Employees**
Lumber and Wood Products Mfg.	3,370
Paper and Allied Products Mfg.	1,180

a Source: Howard, James O., *California Forest Industry, Wood Consumption and Characteristics, 1972*, USDA Forest Service Resource Bulletin PNW-52.

b Source: U.S. Department of Commerce, *County Business Patterns, 1973*.

OUTDOOR RECREATION

The Basin's outdoor recreation industry provides goods and services to support 340 million visitor days of outdoor recreation activity per year. The Basin's 200 campgrounds provide 11,000 campsites for 8 million visitor days of camping use. The most popular activities on the Basin's forest land are camping, driving for pleasure, fishing, and use of recreation residences (Tables VI-4 and VI-5).

TABLE VI-4. CURRENT OUTDOOR RECREATION ACTIVITY, SAN JOAQUIN VALLEY BASIN

(Millions of Recreation Visitor Days)

ACTIVITY	TOTAL
Driving for Pleasure	71.6
Swimming	52.4
Sightseeing & Nature walks	41.2
Walking for Pleasure	37.3
Playing Outdoor Sports & Games	28.7
Picnicking	17.4
Boating	14.6
Fishing	14.0
Bicycling	13.6
Attending Outdoor Sports Events, Concerts, Dramas	9.3
Camping	8.0
Waterskiing	6.6
Horseback Riding	6.0
Hiking	5.6
Hunting	4.2
Snow Skiing	.3
Snowplay & Sledding	.1
Miscellaneous	6.6
Total	337.5

Source: Estimates from Parks and Recreation Information System (PARIS), California Department of Parks and Recreation.

TABLE VI-5. RECREATION ACTIVITY IN NATIONAL FORESTS, SAN JOAQUIN VALLEY BASIN, 1974

(Thousands of Recreation Visitor Days)

ACTIVITY		TOTAL
All Camping		4,611
Family Camping	4,136	
Organizational Camping	475	
Auto, Scooter, Motorcycle Driving		2,032
Fishing		864
Recreational Residences		863
General Leisure & Sightseeing		518
Walking & Hiking		479
Swimming & Bathing		464
All Hunting		366
Big Game	299	
Small Game	40	
Upland Birds	27	
Resort Lodging		339
Boating		269
Snow Skiing		244
Picnicking		155
Horseback Riding		113
Snowplay, Sledding, Tobogganing, Ice & Snowcraft		92
Waterskiing & Other Watersports		74
Other Activities		307
Total		11,790

Source: U.S. Forest Service, Recreation Information Management

chapter VII the future under current programs

san joaquin valley basin study

CUCAMONGA BROME USED AS STRIP COVER CROP IN ORCHARD

chapter VII the future under current programs

san joaquin valley basin study

There are a number of federal, state and local programs aimed at protecting and developing the Basin's resources.

The projected future of the Basin takes into account these already existing programs. This reflects the future of the Basin without any of the recommendations proposed in the Preferred Plan.

existing programs

Current programs are administered and operated by a wide variety of agencies and organizations. This study is concerned primarily with available USDA programs and their potential for solving some problems within the Basin.

The following list outlines the major resource programs in the Basin.

ASSISTING AGENCIES FOR EXISTING PROGRAMS

U.S. Department of Agriculture

Soil Conservation Service (SCS)

Operates an ongoing conservation operations program as mandated by Public Law 46. Under this program SCS provides technical assistance to landowners and operators in developing and applying soil and water conservation practices. Provides technical assistance on recreation developments on private lands.

Administers the small watershed program as authorized by Public Law 566. Four PL-566 projects are currently in operation in the Basin: Newman, Stone Corral, Buttonwillow, and Mustang Creek Watershed Projects. Is responsible for standard soil surveys as part of the National Cooperative Soil Survey program.

Forest Service (FS)

The Forest Service is responsible for administering and managing all land within the National Forests for multiple-use and sustained yield as mandated by the Multiple-Use Sustained Yield Act of 1960 and the National Forest Management Act of 1976.

The Forest Service is also responsible for providing leadership in guiding, assisting and promoting improved protection, management, utilization and environmental enhancement of non-National Forest lands and related resources. This is accomplished by cooperatively working with and through various State, private, and Federal organizations. State forestry agencies have an important role in such efforts since the activities are coordinated through their offices.

This cooperative effort involves primarily the following programs: small watersheds (PL-566), river basin planning, resource conservation and development areas, nurseries and tree improvement, municipal watersheds, cooperative forest management, forest products harvesting, manufacturing and marketing, detection, evaluation, and suppression of insects and diseases, wildfire prevention and suppression, threatened and endangered species, flood prevention, recreation development assistance, and land use planning assistance to the State Forester and to state and local planning agencies.

The Federal Government, through the Forest Service, furnishes grants and technical assistance to the State, other agencies and groups, for the purpose of effecting adequate protection, good management, and proper use of non-Federal forest and watershed land.

Agricultural Stabilization and Conservation Service (ASCS)

Provides cost-sharing assistance to landowners/operators to install conservation practices which would: protect productivity of agricultural and forest lands, protect or improve agricultural water sources, or reduce pollution. Most of the practices recommended in the Preferred Plan are eligible for cost-sharing.

Farmers Home Administration (FmHA)

Provides loans and financial advice to farmers for: purchase of equipment or land, purchase of livestock, development of forestry or recreational enterprises, improvement or construction of farm buildings, development of rural water or sewage systems, and installation of PL-566 measures.

Cooperative Extension Service (CES)

Provides education and informational services to landowners and operators. Provides up-to-date information on newest farming techniques, crop varieties, fertilizers, irrigation systems, etc.

Other Federal Agencies

Bureau of Reclamation (BuRec)

Operates a number of water control projects in the Basin (Table IV-9). These provide irrigation supplies, power, flood control, municipal and industrial water supplies, and recreation.

Army Corps of Engineers (CORPS)

Operates a series of dams in the Basin. They also serve a variety of purposes. Two projects were completed in 1976: Buchanan and Hidden Reservoirs. New Melones Reservoir is currently under construction.

Bureau of Land Management (BLM)

Administers approximately 825,000 acres of public land in the Basin. Provides recreation facilities on BLM land.

Bureau of Indian Affairs (BIA)

Administers and provides assistance to Tule Indian Reservation. Land use includes grazing and cropland.

National Park Service (NPS)

Administers and manages three National Parks and one National Monument in the Basin, provides recreation facilities, and manages land for wilderness.

Fish and Wildlife Service (FWS)

Operates Kern-Pixley, San Luis, Merced, and Kesterson National Wildlife Refuges. The Service also provides input and advice, under authority of the Fish and Wildlife Coordination Act, to the Bureau of Reclamation, Corps of Engineers, and Soil Conservation Service concerning fish and wildlife habitat mitigation, preservation, and enhancement in conjunction with water projects initiated by these agencies. Administers the Endangered Species program of the U.S. Department of Interior.

State Agencies

Department of Water Resources (DWR)

Administers and coordinates water projects. Operates the California Water Project and coordinates the Central Valley Project which involves federal and state water projects.

Administers water policies for the State of California. Responsible for State Water Plan.

Department of Fish & Game (DFG)

Conducts cooperative habitat improvement programs with the Forest Service, Soil Conservation Service, Resource Conservation Districts, and other agencies.

Manages State wildlife areas. There are three State wildlife areas in the Basin: Volta, Los Banos, and Mendota.

Provides technical advice to private landowners and other agencies.

Identifies rare and endangered species and critical habitats.

Department of Forestry (CDF)

Cooperates with Kern County Fire Department, Bureau of Land Management, Bureau of Indian Affairs, National Park Service, and Forest Service to provide prevention, suppression, and control of wildfires.

Administers California Forest Practices Act which regulates logging activities on private forest land and is responsible for the California Soil Vegetation Survey.

Provides technical advice to private forest landowners through the Cooperative Forest Management Program.

Provides technical advice to landowners on conducting range improvement burns and other range improvement techniques, range management, general brush control methods (mechanical, fire, or chemical), and watershed management procedures. Manages Mountain Home State Forest.

Department of Parks and Recreation

Administers facilities in the State Park System. The Basin contains ten state parks, one of which is a wildlife reserve.

Provides grants to local agencies for park development.

Department of Transportation (CALTRANS)

Plans State highway improvements. Manages facilities at roadside rest areas.

Department of Conservation

The Resource Conservation Commission provides direction and leadership for resource conservation activities being carried on by Resource Conservation Districts throughout the State.

The Division of Mines and Geology identifies geologic and seismic hazards and conditions and provides valuable information for making informed land use decisions.

The Division of Oil and Gas regulates the oil, gas, and geothermal resources operations within the State.

Local Agencies

Resource Conservation Districts (RCD's)

There are a number of local RCD's in the San Joaquin Valley Basin. They work with SCS to provide technical assistance on conservation plans and practices to landowners and operators. They enter into agreements with state and Federal agencies to supply assistance to local people. They act as a link between government agencies and individual resources managers.

Irrigation Districts

There are many local irrigation districts. Their primary purpose is to supply and distribute irrigation and municipal and industrial water.

WATERFOWL POND DEVELOPMENT

projected future

WATER MANAGEMENT

Flooding

Flooding is expected to continue in the same pattern. The general rainfall floods of late fall and winter will continue to cause a majority of the damage (Table V-1.)

Average annual flood damages are expected to remain the same, $21,097,000.

Poor Drainage

There are a number of ongoing projects planned to reduce the drainage problem. Despite these programs, drainage conditions are expected to deteriorate in the future.

Two PL-566 projects currently under construction will reduce the drainage problem. Newman Watershed Project will drain 3,030 acres in Stanislaus County and Stone Corral will drain 1,320 acres in Tulare County for a total of 4,350 acres.

In addition to these PL-566 projects, two other areas are involved in drainage projects. The Westlands Water District plans to drain 246,000 acres in Fresno and Kings Counties and the Tulare Lake Drainage District will drain 178,000 acres in Kings and Tulare Counties.

Ongoing Soil Conservation Service technical assistance is expected to aid in drainage of another 25,000 acres.

Table VII-1 summarizes the expected future of drainage conditions.

TABLE VII-1. PROJECTED DRAINAGE CONDITIONS SAN JOAQUIN VALLEY BASIN [a]

	1975 (Acres)	2000 (Acres)	Change (Acres)
Partially Drained	1,251,000	797,000	−454,000
Poorly Drained	741,000	1,977,000	+1,236,000
Total Problem	1,992,000	2,774,000	+782,000

a These figures do not take into account existing projects.

The total problem area is expected to increase by 782,000 acres; 1,236,000 acres will move from partially drained to poorly drained and 782,000 acres will move from a potential problem to partially drained.

The existing programs can be expected to reduce the drainage problem on 453,300 acres. This still leaves 2,320,700 acres with a drainage problem by year 2000 (Table VII-2), which represents an increase of 328,700 acres.

It should be noted that by providing subsurface drainage systems, the change will be to partially drained condition by definition only. A properly installed drainage system will provide adequate drainage for production purposes by lowering the water table to between 6 feet to 9 feet below the ground surface.

TABLE VII-2. DRAINAGE PROBLEMS IN YEAR 2000 WITH PLANNED PROGRAMS, SAN JOAQUIN VALLEY BASIN

Poorly Drained	1,977,000 acres
Partially Drained	797,000 acres
TOTAL PROBLEM — YEAR 2000	2,774,000 acres
Less planned programs	
Stone Corral Watershed Project	1,300 acres
Newman Watershed Project	3,000 acres
SCS Technical Assistance	25,000 acres
Westlands Water District	246,000 acres
Tulare Lake Drainage District	178,000 acres
TOTAL PLANNED	453,300 acres
TOTAL UNSOLVED PROBLEM — YEAR 2000:	
2,774,000 — 453,300 = 2,320,700 acres	

The Drainage Problem Areas maps following page 82 show the future drainage problems projected to the year 2000 for each subbasin. These maps present an estimate of the drainage problem of the future without projected action.

The year 2000 drainage problem maps do not reflect the effects of the Stone Corral and Newman PL-566 projects, which at the time of the map preparations were still in the design stage.

The following assumptions were used in preparing these maps:

Assumption:

Eastside Canal will not be constructed.

Half the deterioration will occur by 1985.

SEDIMENTATION IN FIELD

San Joaquin Subbasin:

Westside—All of partially drained area will deteriorate to poorly drained condition except areas with a drainage system.

—All of potential drainage problem area will deteriorate to partially drained condition.

Eastside—All of partially drained area will deteriorate to poorly drained condition except for areas with a drainage system.

—25 percent of potential drainage problem area will deteriorate to partially drained condition.

Tulare Subbasin:

Westside—All of partially drained area will deteriorate to poorly drained condition except areas with a drainage system.

—33 percent of potential drainage problem area will deteriorate to partially drained condition.

Eastside—All of partially drained area will deteriorate to poorly drained condition except areas with a drainage system.

—17 percent of potential drainage problem area will deteriorate to partially drained condition.

Irrigation Water

The irrigation water problems in the Basin are also expected to increase under current programs.

Assuming no significant changes in state policy, groundwater will still be heavily relied on for irrigation supplies. This will lead to further water quality degradation and groundwater overdraft. Poor quality groundwater, used for irrigation, will compound the salt concentration problem in the soil. At present rates, enough salts are being added to the groundwater each year to reduce the quality by 30 ppm (1). The continual overdraft of groundwater supplies will lead to lower groundwater tables. This will mean increased pumping costs.

Areas affected by high boron concentrations will continue to have problems. In areas already affected, concentrations may increase, but the problem is not expected to spread to new areas.

Overall on-farm irrigation efficiency in the Basin is expected to increase by 2 percent by 1985 and another 3 percent by 2000. This is attributable to increasing pumping costs for underground water and waste discharge regulations.

Public Law 92-500 (Federal Water Pollution Control Act) is expected to help achieve higher efficiencies in the San Joaquin subbasin. The law calls for zero discharge of pollutants into surface waters. The target water quality for the San Joaquin River is presently 500 ppm or less of total dissolved solids (17).

Irrigation water use will continue to increase over time (Table VII-3). If current irrigation water use efficiencies persist over time under D-100 production projections, water use will increase by about 1 million acre-feet by the year 1985 and 1.7 million acre-feet by 2000. A 2 percent improvement in on-farm irrigation efficiencies by 1985 would limit the increase in water use to about 500,000 acre-feet. If an additional 3 percent on-farm irrigation efficiency increase is realized between 1985 and 2000, irrigation water use would increase only about 1 million acre-feet over the base period levels.

TABLE VII-3. IRRIGATION WATER USE WITH D-100 PRODUCTION LEVELS, SAN JOAQUIN VALLEY BASIN

YEAR	CURRENT EFFICIENCY	IMPROVED EFFICIENCY	DIFFERENCE
	(Millions of Acre Feet)		
BASE	16.389	— —	16.389
1985	17.442	16.938	.504
2000	18.062	17.032	1.030

Source:

1. California Department of Water Resources Publication, Bulletin No. 160-74
2. River Basin analytical model solutions.

LAND MANAGEMENT

Developed Campsites

Demand for camping at developed sites is expected to increase significantly from the present level of 8.0 million recreation days to 13.4 million in the year 2000 (Figure VII-1). Because of the high quality of the Basin's recreation resources, and the relative scarcity of adequate recreational opportunities in or near large urban centers, more than 80 percent of this demand will come from non-residents of the Basin. The majority of this non-resident demand is from the Los Angeles and San Francisco metropolitan areas. Some of this future demand will be accommodated.

Based on recent trends and current policies, the River Basin Planning Staff estimates that about 3000 additional campsites will be developed under ongoing public and private development programs by the year 2000.

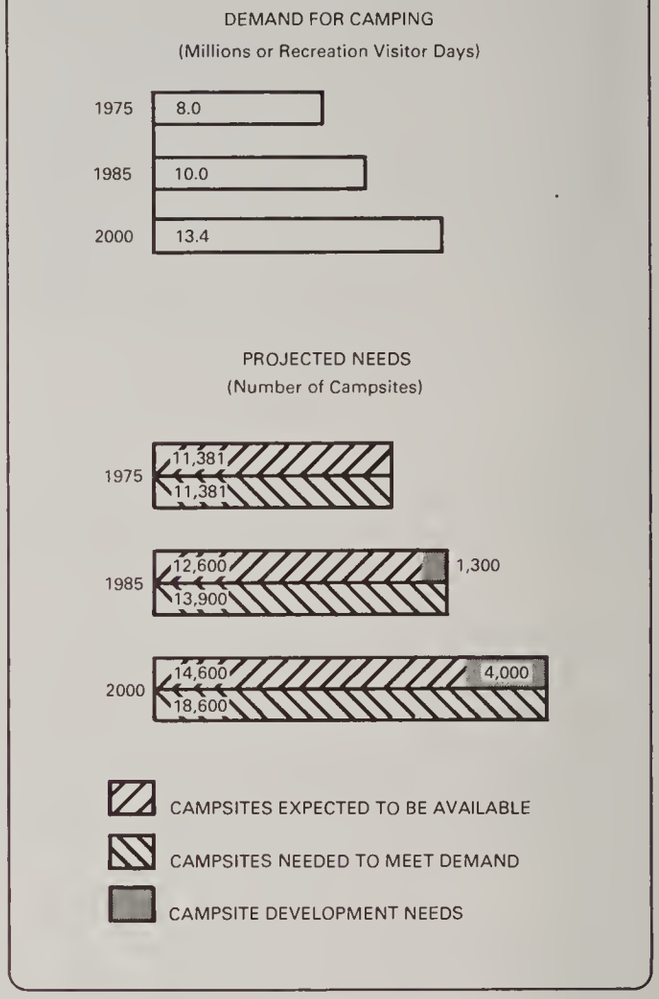
The supply of land suitable for campsite development is not a limiting factor for development by either the public or private sectors.

Campsite development is not expected to keep pace with demand because of high costs to upgrade current facilities to meet water pollution, health and safety standards; limited public agency budgets; and priority given to undeveloped rather than developed recreation.

Private facilities are also expected to expand slowly. The high cost of development, operation, and maintenance, in realtion to fees campers are willing to pay, limit development in the private sector. Private campground operators currently charge between $3 and $8 per campsite per day. Public agencies generally charge less than cost and often provide similar facilities free of charge.

Projected increases in campsite development and utilization expected under ongoing programs are not sufficient to meet projected demands. If projected demands are to be met, 4000 additional campsites need to be developed by the year 2000 (Figure VII-1). Estimated campsite development needs are sensitive to estimated utilization rates and user fees. Higher utilization rates or user fees would reduce the need for additional campsite development.

FIGURE VII-1. PROJECTED NEEDS FOR DEVELOPED CAMPSITES, SAN JOAQUIN VALLEY BASIN



Timber Production

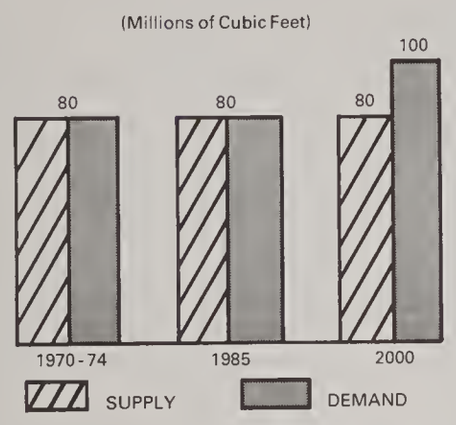
Demand for San Joaquin Valley Basin timber is expected to grow from 80 million cubic feet to 100 million cubic feet annually (Figure VII-2).

Under current programs the production of Basin timber is projected to remain constant on an average annual basis. However, timber production could increase if management of the Basin's timberland were intensified.

Wilderness Preservation

Organized groups and interested individuals have expressed a desire to preserve nearly all lands with wilderness characteristics. Existing Forest Service and National Park Service inventories indicate there are 2.9 million acres with these characteristics in the Basin (Figure V-1).

FIGURE VII-2. PROJECTED ANNUAL NEEDS FOR TIMBER PRODUCTION, SAN JOAQUIN VALLEY BASIN



Source:
Data for 1970-74 is average annual production computed from data reported by the California Department of Forestry and U.S. Forest Service. Supply estimates for 1985 and 2000 are River Basin Planning Staff estimates based on allowable harvests for National Forest and harvest trends on private land.

The River Basin Planning Staff estimates that land having wilderness characteristics will decline from 2.9 million to about 2.6 million acres by the year 2000. These estimates are based on the assumption that only those lands managed primarily for preservation of wilderness values will maintain their wilderness characteristics over the long term. The staff estimates that land managed for this purpose will increase from its present level of about 500,000 acres to about 2.6 million acres by the year 2000.

Range Forage

The condition of the Basin's rangeland is expected to deteriorate despite available conservation assistance. The total amount of problem rangeland remains the same, but a higher percentage will be in the more critical problem classes.

By 2000, there will be a projected decrease in production from 2,650,000 to 2,470,000 animal unit months annually (Figure VII-3). This represents a loss of $3,900,000 in 1975 dollars.

Approximately 20 percent of the lost forage production can be attributed to erosion.

Lost forage production also means less cover on rangeland. This allows more erosion with the resulting sediment damaging streams and reservoirs.

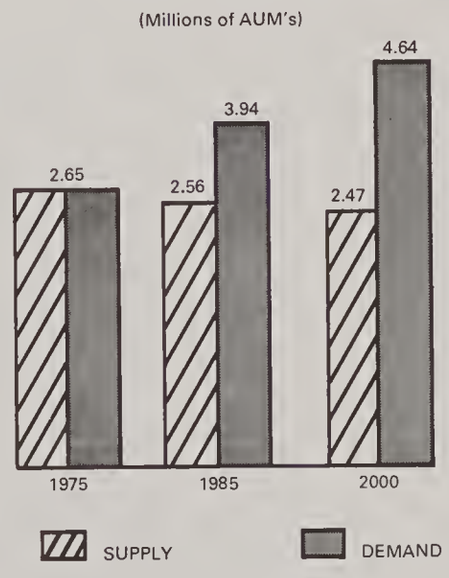
Erosion and Sedimentation

Wind erosion is expected to decrease as landowners and operators improve cultural practices and shift to cropping patterns that minimize the amount of land left bare. The affected area is expected to decrease from 173,000 acres to 121,000 acres by 2000. This will reduce annual damages by $2.6 million (1975 dollars).

Sheet and gully erosion in the foothills is expected to accelerate as rangeland deteriorates. Erosion and sedimentation from forest lands are expected to decrease as a result of improved management on National Forests and implementation of the California Forest Practice Act on private lands.

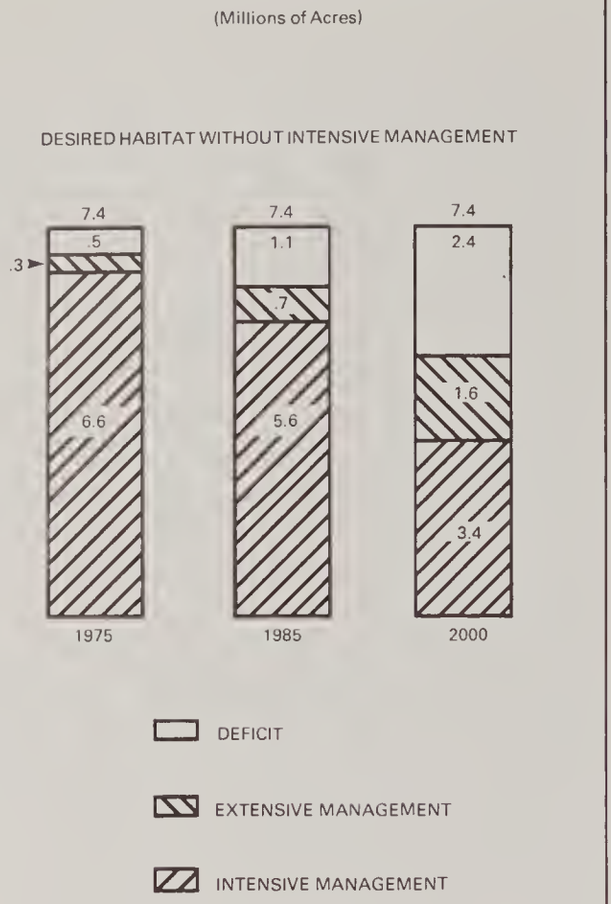
Sediment yield will increase with the increased erosion. An expected 25 percent increase in sediment will further reduce stream and reservoir capacity causing more frequent flooding. This results in increased turbidity and total suspended solids as water pollutants.

FIGURE VII-3. PROJECTED ANNUAL SUPPLY OF RANGE FORAGE PRODUCTION, SAN JOAQUIN VALLEY BASIN



Source:
USDA River Basin Planning Staff estimates based on range site evaluation, historical trends, and 1972 OBERS Projections, U.S. Water Resources Council.

FIGURE VII-4. PROJECTED DEER HABITAT DECLINE, DEER HABITAT DEFICIT AND DESIRED NEEDS, SAN JOAQUIN VALLEY BASIN



Deer Habitat

Deer habitat is expected to decrease by 2.4 million acres by 2000 (Figure VII-4). A program for improving 3,400 acres of habitat annually has been proposed by the California Department of Fish and Game and the Forest Service, but has not yet been implemented. Even if the program were initiated, it would provide less than 5 percent of the improved habitat needed to offset projected losses.

Desired deer habitat needs are shown in Figure VII-4. If desired habitat conditions are to be achieved, 1.6 million acres will need to be intensively managed to improve browse species composition by the year 2000. Intensively managed habitat can offset anticipated habitat losses because it is approximately 2.5 times as productive as habitat with poor browse species composition.

Other Wildlife Habitat

Of the fourteen habitat types in Chapter IV, only four are projected to increase, and these are not the more productive wildlife habitats. The four habitats with increasing acreage are: Agriculture, Urban-Industrial, Lakes-Reservoirs, and Pine-Fir-Chaparral. Refer to Table IV-7 for a description of the habitat types.

Even with current programs such as Waterbank and State and Federal wildlife areas, wetland habitat is projected to decline. Riparian habitat is expected to decline from the already low 67,775 acres to approximately 18,000 acres in 2000.

The largest drop is projected for grassland habitat from 3.8 million acres to 890,000 acres by 2000 (6).

Wildfires

Wildfire protection for 11.4 million acres of forest and rangeland is provided by six agencies (Table VII-4). These agencies employ nearly 1,100 people in fire management activities. Current plans call for increasing management employment to nearly 1,500 people and making capital investments of about $50 million by the year 2000.

Increased fire management under existing programs is not expected to keep pace with projected fire problems (Table VII-5). Population pressures on forest and brush-covered lands are expected to increase 68 percent by 2000. This will lead to an increase in both the number of fires and the total acreage burned. For fires larger than 10 acres, the number and acreage burned is expected to increase 11 percent by 2000.

TABLE VII-4. CURRENT WILDFIRE PROTECTION AREA RESPONSIBILITY BY AGENCY, SAN JOAQUIN VALLEY BASIN

	(Thousands of Acres)
California Department of Forestry	4,854
U.S. Forest Service	3,551
Kern County Fire Department	1,696
National Park Service	1,154
Bureau of Land Management	121
Bureau of Indian Affairs	54
TOTAL	11,430

Source:
California Department of Forestry

TABLE VII-5. WILDFIRE CONDITIONS EXPECTED UNDER THE ON-GOING PROGRAM, SAN JOAQUIN VALLEY BASIN

DESCRIPTION	UNITS	1975	2000 ON-GOING PROGRAM
Fires a	Number	77	86
Acres Burned, Annual	Thousands of Acres	34.7	39.0
Fire Size, Average	Acres	451	454
Protection Area	Millions of Acres	11.4	10.4
Employment Total	Number of Employees	1078	1485
Annual Cost	Millions of Dollars	11.7	16.8
Capital Investment Cost-Total	Millions of Dollars	49.8	49.8
Annual Average *b* Capital Cost	Millions of Dollars	4.5	4.1

a Fires larger than 10 acres in size.

b Capital investment amortized for 20 years at 6⅜ percent interest.

FIRES IMPACT PLANTS AND ANIMALS

ECONOMIC PROJECTIONS

A variety of statistics are available on the future economy of the State and Nation. Two projections were used in this study: OBERS E' projections developed by the U. S. Water Resources Council and D-100 projections developed by the State of California Department of Water Resources (8, 20).

The D-100 projections were used for defining needs and formulating plans in this study.

The fundamental difference between these two projections is the assumption about fertility rates. OBERS E' assumes a fertility rate of 2.1 (2100 live births during the life cycle of 1000 women) and D-100 assumes a fertility rate of 2.5 (2500 live births during the life cycle of 1000 women). This basic assumption affects all the other assumptions. It will result in different future population estimates, which in turn will affect the consumption of agricultural goods, production of agricultural goods, rate of urbanization, and demand for water.

These two projections provide a range of alternative futures, which allow flexibility in making and changing decisions. The difference in possible futures between the two is illustrated in per capita consumption. D-100 projects a gradual but steady increase in consumption; while OBERS E' projects a rather sharp increase followed by a reduction to midway between 1970 and 1985 levels (Table VII-6).

TABLE VII-6. PER CAPITA CONSUMPTION PROJECTIONS, D-100 AND OBERS E' PROJECTIONS, SAN JOAQUIN VALLEY BASIN

	1975	1985	2000
	(Pounds per Year)		
Fruits & Nuts			
D-100	440	432 a	427
OBERS E'	440	443	446
Vegetables			
D-100	839	804 a	776
OBERS E'	839	817	788
Field Crops			
D-100	359	376 a	392
OBERS E'	359	373	385
Livestock Products			
D-100	175	204 *a*	227
OBERS E'	175	203	205
Total			
D-100	1,813	1,816 a	1,822
OBERS E'	1,813	1,836	1,824

a Interpolation estimate.

Source: 1. Agriculture Statistics Report, 1974.
2. DWR memo: Crop Market Outlook Study, Based on Series D National Population, September 17, 1973.
3. 1972 OBERS Projections, Series C Population, Vol. 1, September 1972.
4. 1972 OBERS Projections, Series E Population, Vol. 1, April 1974.
5. 1972 OBERS Projections, Series E' Population Supplement, Vol. 1, May 1975.

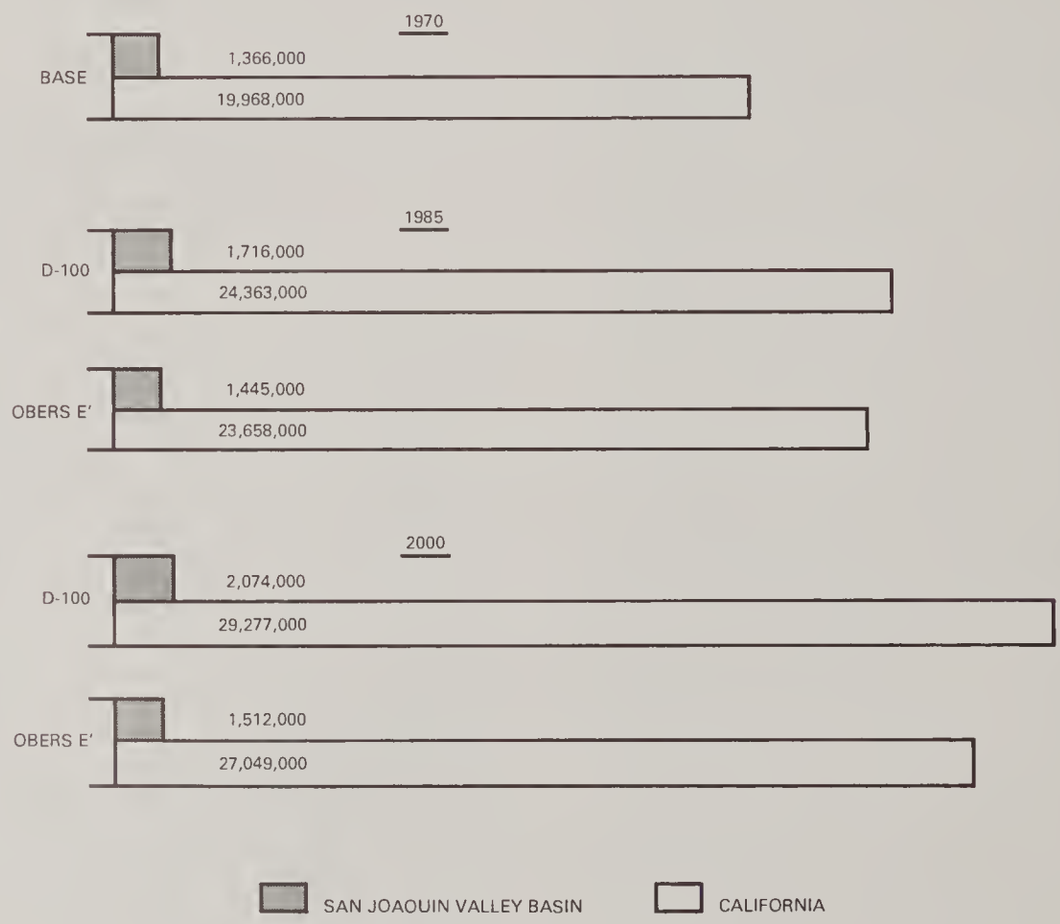
RANGELAND CONVERTED TO RESIDENTIAL USE

Population

Future population is determined by considering both the fertility rate and the immigration into the State. D-100 assumes a fertility of 2.5 and an annual immigration of 100,000 through the year 2000. OBERS E' assumes a lower fertility rate and lower immigration.

Both projections show increasing populations in the Basin and the State (Figure VII-5). OBERS E' predicts the rest of the State will grow faster than the Basin, while D-100 predicts approximately the same growth for both.

FIGURE VII-5. POPULATION PROJECTIONS, SAN JOAQUIN VALLEY BASIN AND CALIFORNIA



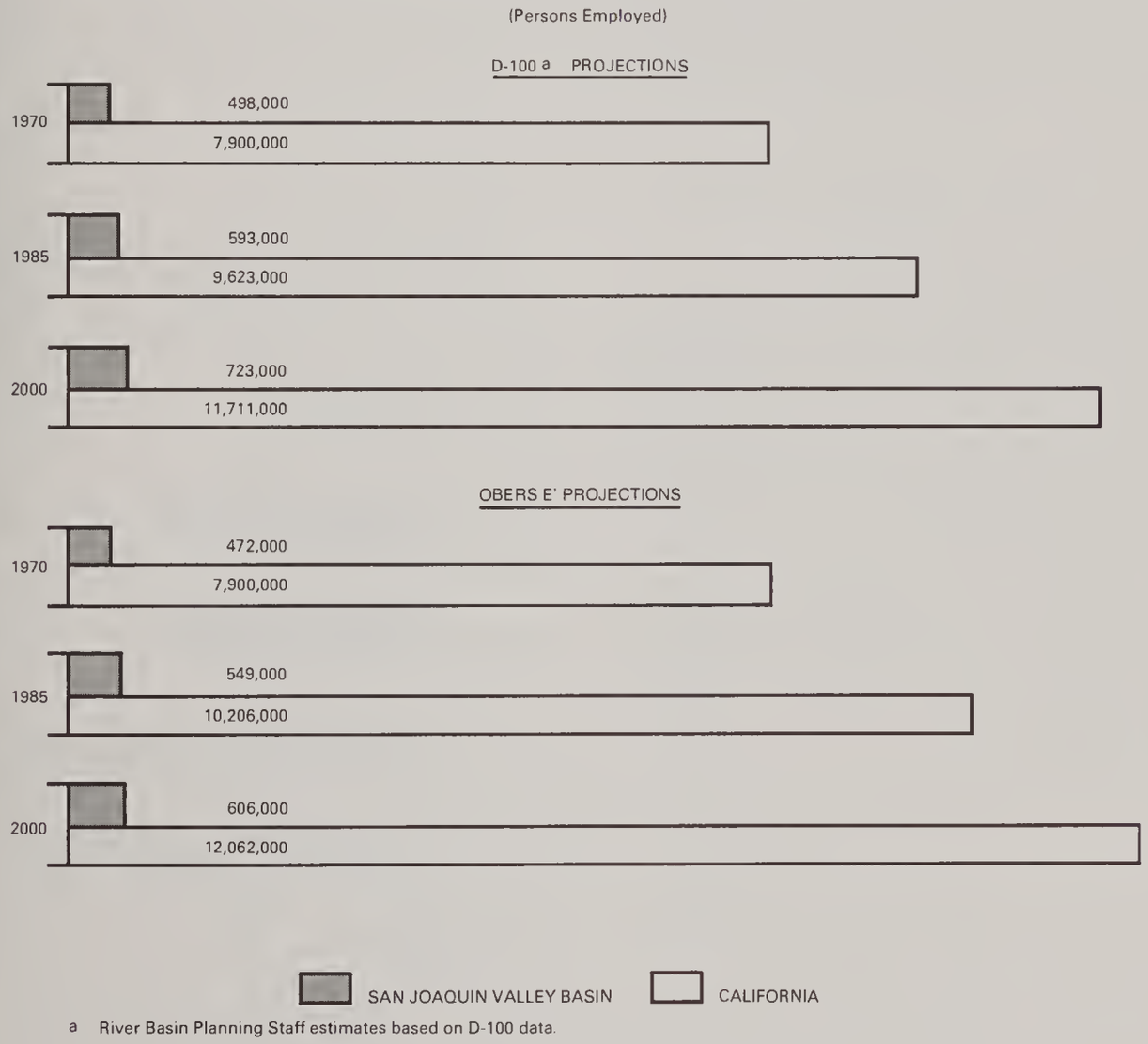
Employment

Agriculture and related industries will continue to supply a majority of the Basin's jobs.

Total employment in the Basin is projected to increase. OBERS E' projections are consistently lower than D-100 projections for the Basin, but higher for the State. Currently, the Basin accounts for approximately 6.5 percent of the State's labor force. D-100 projections show this relationship remaining fairly constant. OBERS E' forecasts that the Basin will reduce its share of the State's labor force by 5 percent by 2000 (Figure VII-6).

AGRICULTURAL WORKERS HARVESTING TOMATOES

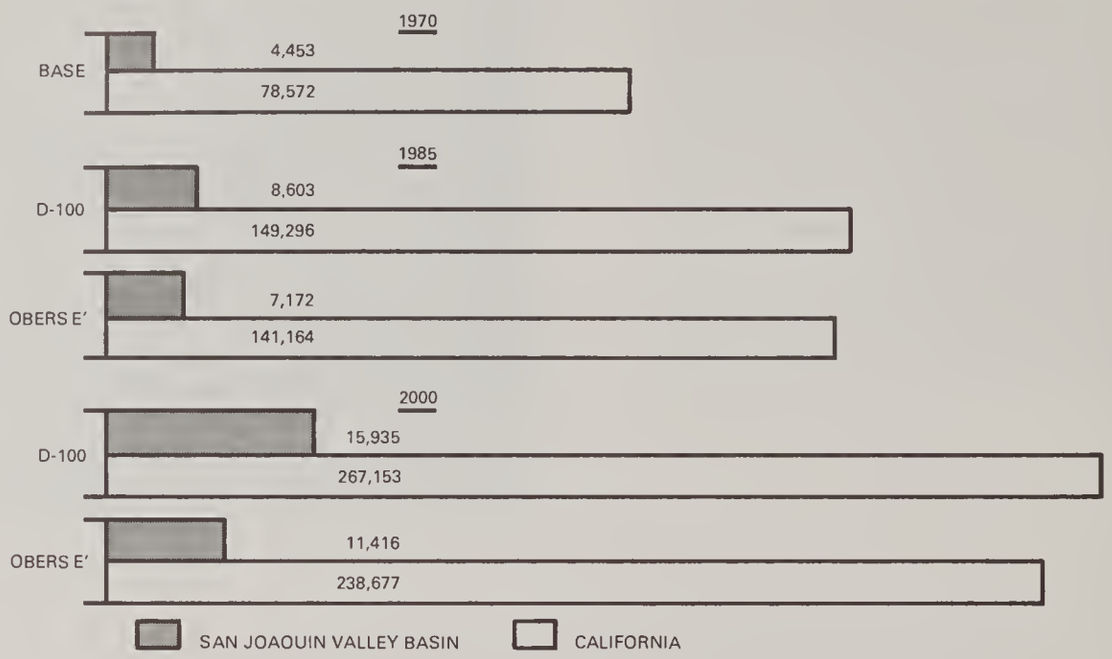
FIGURE VII-6. EMPLOYMENT PROJECTIONS, SAN JOAQUIN VALLEY BASIN AND CALIFORNIA



a River Basin Planning Staff estimates based on D-100 data.

FIGURE VII-7. INCOME PROJECTIONS, SAN JOAQUIN VALLEY BASIN AND CALIFORNIA

(Millions of Dollars)



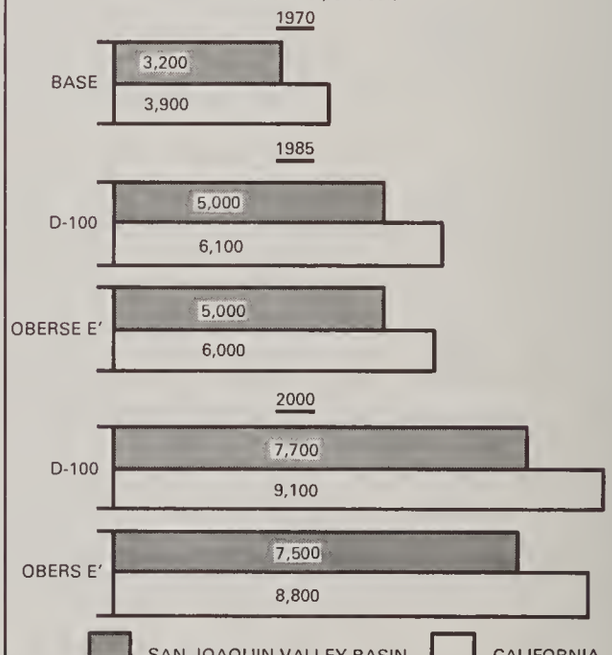
Income

Both projections show increases in the Basin's future income. D-100 projections show the Basin claiming a slightly higher percentage of the total State income by 2000. On the other hand, OBERS E' predicts the Basin will account for a smaller percentage of the State income in 2000 than in 1970 (Figure VII-7).

Both projections show income increasing faster than population. This means an increase in per capita income. D-100 projects per capita income in the San Joaquin subbasin will increase considerably faster than in the Tulare subbasin (Figure VII-8).

FIGURE VII-8. PER CAPITA INCOME, SAN JOAQUIN VALLEY BASIN

(Dollars per Year)



Source:
1. Figure VII-5, Population Projections.
2. Figure VII-7, Income Projections.

TABLE VII-7. CROP PRODUCTION, D-100 AND OBERS E' PROJECTIONS, SAN JOAQUIN VALLEY BASIN

CROP PROJECTION	BASE	1985	2000
	(Thousands of Tons)		
Fruits & Nuts			
Almonds			
D-100	100	102	130
OBERS E'	100	82	101
Walnuts			
D-100	60	68	75
OBERS E'	60	55	66
Grapes			
D-100	2,288	3,553	4,170
OBERS E'	2,288	2,865	3,391
Deciduous			
D-100	1,053	1,403	1,724
OBERS E'	1,053	1,064	1,252
Citrus			
D-100	821	1,788	2,514
OBERS E'	821	1,442	1,848
Olives			
D-100	49	62	79
OBERS E'	49	50	57
Figs			
D-100	22	35	43
OBERS E'	22	28	32
Vegetables			
Lima Beans			
D-100	18	28	33
OBERS E'	18	28	35
Lettuce			
D-100	83	366	539
OBERS E'	83	361	556
Melons			
D-100	311	483	591
OBERS E'	311	476	595
Potatoes			
D-100	826	762	894
OBERS E'	826	914	1,018
Tomatoes			
D-100	1,573	2,494	3,372
OBERS E'	1,573	2,468	3,398
Field Crops			
Barley/Wheat			
D-100	1,252	1,120	1,215
OBERS E'	1,252	1,059	971
Dry Beans			
D-100	70	142	171
OBERS E'	70	113	106
Corn			
D-100	277	392	469
OBERS E'	277	394	576
Cotton			
D-100	335	359	408
OBERS E'	335	372	394
Alfalfa Hay			
D-100	4,495	5,694	6,480
OBERS E'	4,495	5,250	6,164
Rice			
D-100	83	90	106
OBERS E'	83	103	122
Safflower			
D-100	100	117	125
OBERS E'	100	117	125
Seed			
D-100	36	27	28
OBERS E'	36	27	28
Silage			
D-100	2,544	3,510	4,214
OBERS E'	2,544	3,153	4,055
Sorghum			
D-100	280	278	297
OBERS E'	280	298	218
Sugarbeets			
D-100	2,998	3,831	4,962
OBERS E'	2,998	3,629	4,648

Source: 1. DWR memo Report Crop Market Outlook Study, September 17, 1973.
2. 1972 OBERS Projections, Series E' Population Supplement, May 1975.

Agricultural Production

Agricultural production in California and the San Joaquin Valley Basin is expected to increase in the future (Table VII-7).

Currently, the San Joaquin Valley Basin produces 46 percent of the state agricultural output. D-100 projections estimate the future percentage of the State's production by individual crops. This is referred to as "market share".

The San Joaquin subbasin is expected to increase its share of the State production for eight crops. Ten crops are expected to maintain constant shares and five crops are expected to produce a smaller share of the State output. In the Tulare subbasin, market shares are expected to increase for twelve crops, remain constant for seven and decline for three.

The twenty-nine major crops are summarized in the seven crop groups indicated in Table VII-8. The irrigated crop acreage is projected to increase under both OBERS E' and D-100 projections. The D-100 acreage increases from the

TABLE VII-8. IRRIGATED ACREAGE COMPARISONS, D-100 AND OBERS E' PROJECTIONS, SAN JOAQUIN VALLEY BASIN

CROP GROUP PROJECTION	BASE	1985	2000
	(Thousands of Acres)		
Fruits & Nuts			
D-100	959	1,153	1,327
OBERS E'	959	923	1,044
Vegetables, All			
D-100	214	292	355
OBERS E'	214	297	366
Cotton			
D-100	711	626	615
OBERS E'	711	649	594
Grains			
D-100	750	720	720
OBERS E'	750	711	622
Roughages			
D-100	1,159	1,303	1,368
OBERS E'	1,159	1,234	1,326
Double Crops			
D-100	70	70	70
OBERS E'	70	70	70
Other Crops			
D-100	496	531	583
OBERS E'	496	499	518
Total			
D-100	4,359	4,695	5,038
OBERS E'	4,359	4,383	4,540

Source: 1. River Basin Planning Staff estimate.
2. River Basin analytical model solutions for 1985 and 2000, February 1977.

base period to 1985 and 2000 are 7.7 and 15.6 percent respectively. The comparable OBERS E' increases are only .5 and 4.1 percent above the base period levels.

The San Joaquin Valley Basin's projected levels of crop production under both OBERS E' and DWR D-100 can be met even with deteriorating drainage conditions. This is mainly due to higher future crop yields. Hence, the NED benefits represent efficiency gains. Discussion of the extent of income increases, irrigated acreage distribution, and land use changes associated with the Preferred Plan can be found in Chapter XI.

LEGEND

Poorly drained-water table within 5 feet or less of the ground surface.

Partially drained-water table between 5 and 10 feet of ground surface during the growing season.

Area with a drainage system-water table between 5 and 10 feet of ground surface with some type of drainage system (drainage wells, open ditch drains, subsurface tile drainage systems, etc.). System effectiveness not determined. Assumed to be partially drained.

Potential drainage problem area under present trends because of soil characteristics or physiographic location.

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carto. Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.

DRAINAGE PROBLEM AREAS

Projected to year 2000 without project action

SAN JOAQUIN SUBBASIN

SAN JOAQUIN VALLEY BASIN, CALIFORNIA

APRIL 1976

10 0 10 20 MILES

SCALE 1:1,140,000

10 0 10 20 30 KILOMETERS

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA SCS PORTLAND OR 1976

M7-SN-23488-10

LEGEND

Poorly drained-water table within 5 feet ar less af the graund surface.

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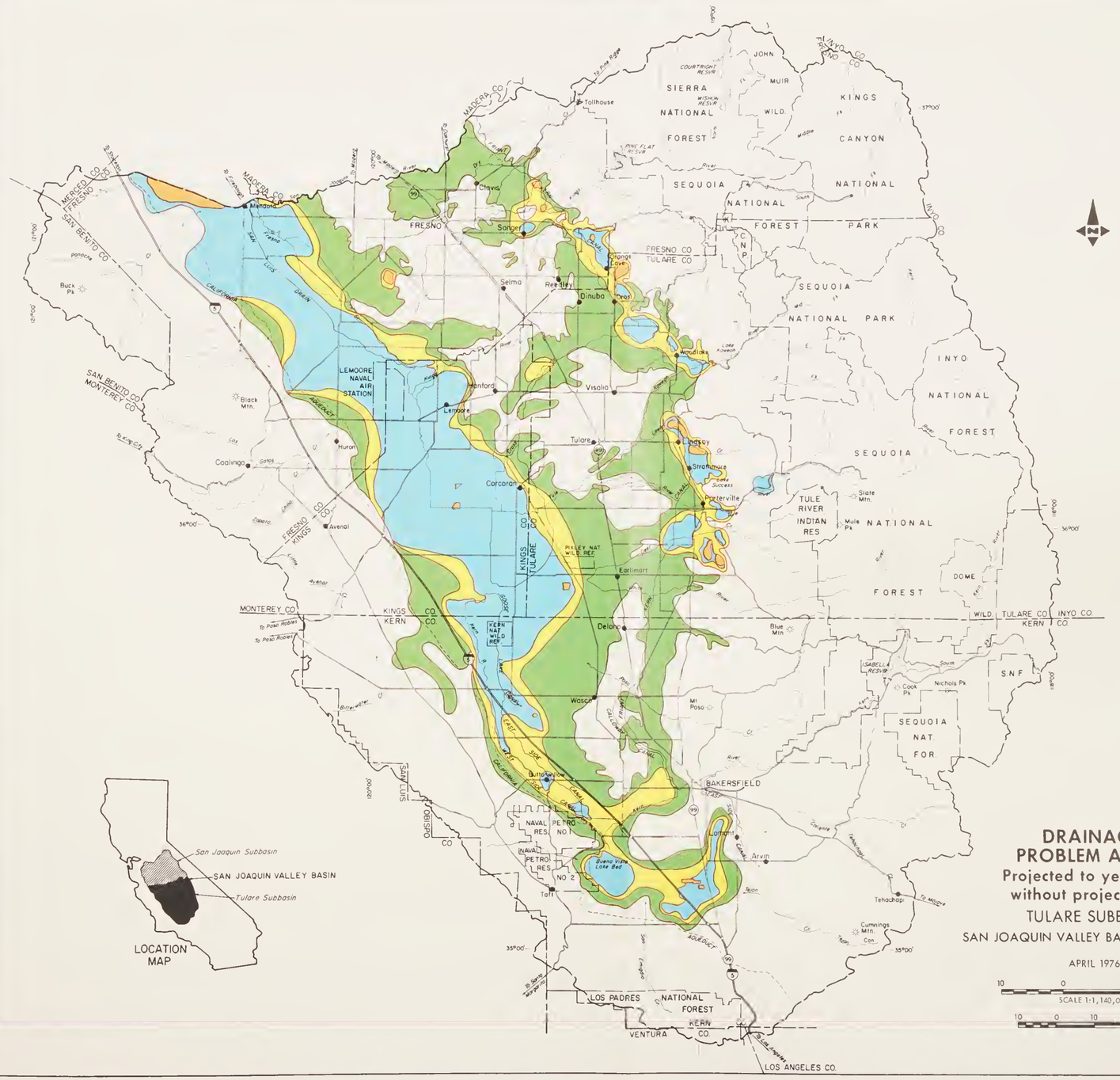
Area with a drainage system-water table between 5 and 10 feet of ground surface with some type af drainage system (drainage wells, open ditch drains, subsurface tile drainage systems, etc.). System effectiveness not determined. Assumed to be partially drained.

Potential drainage problem area under present trends because of sail characteristics or physiographic location.

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carto. Unit from California State Staff compilation.
Thematic detail prepared by California State Staff.

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE



DRAINAGE PROBLEM AREAS

Projected to year 2000 without project action

TULARE SUBBASIN

SAN JOAQUIN VALLEY BASIN, CALIFORNIA

APRIL 1976

10 0 10 20 MILES

SCALE 1:1,140,000

10 0 10 20 30 KILOMETERS

M7-SN-23490-10

chapter VIII summary of needs

san joaquin valley basin study

EMIGRANT WILDERNESS, STANISLAUS
NATIONAL FOREST

chapter VIII summary of needs

san joaquin valley basin study

Needs are defined in this study as problems which are not expected to be solved by ongoing programs over the next 10 years. In most cases, they were estimated by subtracting conditions expected under ongoing programs from projected demands and environmental preferences.

Table VIII-1 summarizes the future demand and the needs in relation to the present conditions. Needs are estimated for the year 2000. These needs were used as a basis for formulating alternative plans.

TABLE VIII—1. SUMMARY OF NEEDS, SAN JOAQUIN VALLEY BASIN

PROBLEM	PRESENT CONDITION	FUTURE DEMAND OR DESIRED CONDITION	FUTURE UNDER ONGOING PROGRAMS	NEEDS
WATER MANAGEMENT				
Flooding	2.25 million acres prone to flooding.	Provide 10% level of protection.	158,000 acres prone to 10% level of flooding.	Provide 10% level of protection for 158,000 acres.
Poor Drainage	Poorly Drained - 741,000 ac. Partially Drained - 1,251,000 ac. TOTAL 1,992,000 ac.	Improve drainage throughout problem area.	Poorly Drained - 1,523,700 ac. Partially Drained - 797,000 ac. TOTAL 2,320,700 ac.	Improve drainage on 2,320,700 acres.
Irrigation Water	762,000 acres affected by boron.	Reduce effects of boron on crops.	762,000 acres w/problem but more intense.	Reduce boron concentration on 762,000 acres.
	849,700 acres with on-farm efficiency less than 60%	Increase efficiency throughout problem area.	849,700 acres with efficiency problem.	Increase efficiency on 849,700 acres.
Other Water Management	Waterfowl and fish habitat are deteriorating.	Improve waterfowl and fish habitats.	Continued decline in habitat.	Preserve existing and develop additional habitat.
LAND MANAGEMENT				
Developed Campsites	11,400 campsites 8,000,000 recreation days per year.	18,600 campsites 13,400,000 recreation days per year.	14,600 campsites 10,500,000 recreation days per year.	4,000 campsites 2,900,000 recreation days per year.
Timber Production	80 million cubic feet per year.	100 million cubic feet per year.	80 million cubic feet per year.	20 million cubic feet per year.
Wilderness Preservation	2.9 million acres.	2.9 million acres.	2.6 million acres.	300,000 acres.
Range Forage	Forage production of 2.65 million AUM's per year. Poor range conditions.	Forage production of 4.64 million AUM's per year.	Forage production of 2.47 million AUM's per year, deteriorating range conditions.	Forage production for 2.17 million AUM's per year. a
Deer Habitat	Declining habitat quantity and quality.	Return habitat to 1965 condition. *b*	Continuing decline in habitat quantity and quality.	Intensive management on 1.6 million acres.
Wildfires	35,000 acres burned annually	Reduced acreage burned.	39,000 acres burned annually.	Reduce annual burn acreage by 4,000 acres, or more.
Erosion and Sedimentation	Over 2 million ac. affected by some kind of erosion. Wind: 173,000 ac. Sheet/gully: 1.9 million ac. Streambank: 685 miles.	Reduce sheet/gully erosion on rangeland and streambank erosion.	Increase in sheet and gully erosion leading to 20% loss of forage production. Increased sediment yield.	Same as range needs, plus reduce streambank erosion on 685 miles.

a OBERS E projections to determine future demand and needs.

b California Department of Fish and Game; *A Plan for California Deer, 1976.*

chapter IX alternative plans

san joaquin valley basin study

TYPICAL SIERRA FOOTHILL RANGE SITE

chapter IX alternative plans

san joaquin valley basin study

Plan components have been assembled into two major groups: *Water Management* and *Land Management*. The Water Management group includes components for flood prevention, drainage improvement, irrigation improvement, and other water management. The Land Management group includes components for developed campsites, timber production, wilderness preservation, range forage, erosion and sedimentation, deer habitat, and wildfire reduction.

Two major plans were formulated: a National Economic Development plan (NED) and an Environmental Quality plan (EQ). The NED plan emphasizes increasing the value of goods and services and improving economic efficiency. The EQ plan emphasizes enhancing the quality of the environment by management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and historical resources and ecological systems.

The plans comply with the "Principles and Standards for Planning Water and Related Land Resources," and USDA guidelines for River Basin studies (19, 21).

Two different procedures were used to formulate alternative plans for water and land management:

1. Plans for water management require local sponsorship and cost-sharing in order to be feasible for implementation under USDA authorities. As a result, the plan preferred by local people was formulated first and used as a base for formulating alternatives. Local preference plans were modified in the direction of environmental quality to form the EQ plan and in the direction of national economic development to form the NED plan. In most cases, local preferences for economic development resulted in the NED plan being the same as the local preference plan.
2. Plans for land management were formed by grouping components of NED and EQ into NED and EQ emphasis plans. The NED plan included components of NED and compatible components of EQ. The EQ plan included components of EQ and compatible components of NED. The Preferred Plan was then developed as a compromise between the NED and EQ plans.

NATIONAL ECONOMIC DEVELOPMENT (NED) ALTERNATIVE PLAN

WATER MANAGEMENT

Flood Prevention

A 10 percent level of flood protection (10-year flood) for 29,800 acres is proposed. Rural communities in each of the proposed projects will receive a 1 percent (100-year flood) level of flood protection.

The flood prevention component also involves reducing erosion on 109,500 acres of cropland and rangeland.

The structural measures proposed are reservoirs to retard flows and store sediment, and channel work and pipelines to remove runoff water.

Drainage Improvement

The NED plan is based on the summation of individual projects to improve drainage conditions by reducing the water table and soil salinity on 500,000 acres.

Along with improving drainage conditions, the eight proposed projects (seven in the San Joaquin subbasin and one in the Tulare subbasin) will provide water for additional irrigation of 65,000 acres.

The proposed drainage measures will also enhance waterfowl habitat and increase fish habitat.

In addition to drainage measures, eight projects will use drainage water for irrigating cropland or wildlife areas.

TABLE IX-1. COMPARISON OF WATER MANAGEMENT COMPONENTS, NED AND EQ ALTERNATIVE PLANS, SAN JOAQUIN VALLEY BASIN

COMPONENTS	UNITS	NED PLAN	EQ PLAN
Flood Prevention			
Reservoirs			
—Flood Protection	No. - Ac. ft	9 - 7,130	13 - 12,780
—Sediment Storage	No. - Ac. ft.	7 - 10,615	9 - 12,960
—Multipurpose	No. - Ac. ft	1 - 140	6 - 2,822
Channel Work	Miles	86	53
Pipeline	Miles	31	43
Acres - Flood Prone - 10% level	Acres	29,800	29,900
Drainage Improvement			
Outlet Pipeline	Miles	499	765
Channel Work	Miles	257	13
Evaporation Basin	No. - Acres	3 - 6,300	3 - 6,500
Acres of improved drainage	Acres	499,400	499,700
Irrigation Improvement			
Canal Lining	Miles	12.0	11.4
Channel Work	Miles	168	170
Pipeline	Miles	38.3	36.7
Regulating Reservoir	No. - Ac. ft	1 - 160	1 - 160
Diversion Dam	No.	1	1
Tailwater Return System[1]	Acres	4,066,000	4,066,000
Multipurpose Reservoir	No. - Ac. ft	1 - 140	1 - 170
Acres - Irrigated and Improved	Acres	88,390	88,390
Other Water Management			
Waterfowl Habitat (Enhance)	Acres	90,900	87,000
Fish Habitat	Acres	3,822	4,042
Multi-purpose Reservoir	No. - Ac. ft	—	7 - 2,982
Fishing Access	Miles	—	4

[1]An economic analysis of tailwater return systems was not made. This item is not included in the four account display.

Irrigation Improvement

The irrigation component provides water for 66,000 acres and improved irrigation systems on 22,000 acres.

Eight of the nine projects with irrigation benefits depend on the drainage component being installed to provide the water for irrigation of 65,000 acres of land not presently irrigated.

The measures proposed are irrigation channel work, irrigation canal lining, irrigation pipeline and one irrigation regulating reservoir.

Other Water Management

The NED plan also provides 91,000 acres of waterfowl habitat enhancement. This is accomplished within the projects proposed for the other components. See Table IX-1 for display of these measures.

LAND MANAGEMENT

Developed Campsites

An additional 4000 campsites are proposed by the year 2000. This will require an investment of about $24 million for installation and $2.4 million per year for operation and maintenance. These campsites could satisfy 2.9 million recreation visitor days of annual camping demand. Because development of these campsites would require only a minimal amount of land (about 1000 acres) and could potentially reduce environmental problems associated with camping in undeveloped areas, these measures are also included in the EQ plan.

Timber Production

Annual timber production could be increased by more than 20 million cubic feet by the year 2000 by limiting projected timberland losses to 40,000 acres and intensifying timber management practices on 620,000 acres of the best timberland.

Increasing annual timber production from 80 million cubic feet to over 100 million cubic feet by the year 2000 would require annual timber management expenditures of about $12.5 million.

This is an increase of $2.7 million over estimated annual expenditures under ongoing programs. About 80 percent of this increased investment would be for National Forest timberland while 20 percent would be for privately owned timberland. Over 75 percent of the timber would be grown on 620,000 acres (38 percent of the timberland base) under intensive management.

Wilderness Preservation

The wilderness inventory would decline to 2.8 million acres as a result of road construction and timber harvesting activities. This alternative would develop 100,000 acres of land having wilderness characteristics for timber production and compatible uses.

Range Forage, Deer Habitat, and Wildfire Reduction

These three components are described together because of strong interdependencies: increased range forage, improved deer habitat quality, and reduced wildfire are joint products of intensified vegetation management. Extensive stands of brush and oak woodlands grow along the foothills between the agricultural and timbered areas of the San Joaquin Valley Basin. These stands provide range forage and wildlife habitat—especially key winter deer range. These stands are also where a major portion of the wildfires start. In addition to being highly flammable, these stands are in close proximity to urbanized areas where the risk of fire starts is greatest.

Range Forage–All Lands

The NED plan is designed to maximize forage production for highest possible yield of red meat. Land treatment measures are shown on Table IX-2.

Assuming the land treatment measures would be installed between 1980 and 1990, annual forage productivity beyond 1990 would be 5.5 mill-

TABLE IX-2. RANGE FORAGE COMPONENT OF NED ALTERNATIVE PLAN, SAN JOAQUIN VALLEY BASIN

SOLUTIONS BY RESOURCE MANAGEMENT SUBSYSTEMS	UNITS	PRIVATE LANDS	NATIONAL FOREST LANDS	BASIN TOTAL
RANGE MANAGEMENT SUBSYSTEM				
ACCESS ROADS	FT.	1,245,200	105,600	1,350,800
BRUSH MANAGEMENT	AC.	243,700	30,000	273,700
DEFERRED GRAZING	AC.	670,500	—	670,500
FENCING	FT.	6,867,800	15,840,000	22,707,800
FERTILIZING	AC.	900,600	15,000	915,600
PROPER GRAZING USE	AC.	3,321,300	599,000	3,920,300
RANGE SEEDING	AC.	412,200	5,800	418,000
SALTING	APPLIC.	5,200	—	5,200
STOCK TRAILS	FT.	2,967,700	—	—
WATERING DEVELOPMENT SUBSYSTEM		—	200 *a*	200 *a*
PIPELINE	FT.	3,882,400	—	3,882,400
POND	NO.	1,090	—	1,090
SPRING DEVELOPMENT	NO.	340	—	340
TROUGH OR TANK	NO.	1,960	—	1,960
WELL	NO.	90	—	90
WILDLIFE WATERING FACILITY	NO.	—	—	—
WILDLIFE MANAGEMENT SUBSYSTEM				
BRUSH MANAGEMENT	AC.	—	—	—
LIVESTOCK EXCLUSION	AC.	2,400	—	2,400
RANGE SEEDING	AC.	—	—	—
WILDLIFE UPLAND HABITAT MANAGEMENT	AC.	—	—	—
RECREATION MANAGEMENT SUBSYSTEM				
ACCESS ROADS	FT.	—	—	—
RECREATION AREA IMPROVEMENT	AC.	—	—	—
RECREATION TRAILS AND WALKWAYS	FT.	—	—	—
EROSION CONTROL SUBSYSTEM				
CRITICAL AREA PLANTING	AC.	6,700	—	6,700
LIVESTOCK EXCLUSION	AC.	6,700	—	6,700
FERTILIZING	AC.	6,700	—	6,700
FIREBREAK	FT.	8,594,800	—	8,594,800

a Water Development Subsystems not itemized.

ion AUM's. Range forage production under this plan is increased by 3.03 million AUM's.

The average annual cost of land treatment measures is $7.9 million. The average annual cost of additional technical assistance is $380,000. The average annual benefits from installing these measures is estimated at $10,339,000.

These measures will also reduce damage from soil compaction, erosion, and sedimentation; improve deer habitat; and reduce the wildfire threat.

Range Forage–Privately Owned Lands

Land treatment measures are shown on Table IX-2. All of the suitable brush areas are converted to grass. No quail guzzlers or quail roosts are planned. Firebreaks and critical area planting are planned for problem area 7 but no recreation improvements are included.

Assuming the land treatment measures would be installed over the ten-year period from 1980 to 1990, annual productivity is projected to reach 5,105,000 animal unit months of grazing from 1990 into the future. This represents an annual gain of 2,872,000 animal unit months over the projected production in the year 2000 if present trends and levels of technical assistance continue.

The increase in productivity would result in an estimated increase of 153,132,000 pounds of livestock gain worth approximately $45,940,000 in 1975 dollars. Wildlife benefits include 2,400 acres of land excluded from grazing to protect critical habitat of endangered species. Wildlife would also benefit from the ponds, springs, and wells developed for livestock.

Critical area plantings totalling 6,700 acres would be excluded from grazing and offer limited habitat for wildlife and reduce erosion and sedimentation damage.

Average annual cost of the land treatment measures is estimated at $7,200,000 for the Basin. Accelerated technical assistance for the ten-year application period would add another $106,400 to the average annual cost. Average annual benefits from increased forage production and wildlife improvements are estimated at $9,588,000.

Erosion and Sedimentation

Sheet and gully erosion on the foothills will be greatly reduced by the proposed range program. The area affected by moderate to severe erosion would be reduced 60 percent by 1990. The value of this improvement has been reflected in the improved forage production discussed under Range Forage. The amount of eroded material reaching live streams will be reduced from 25 percent at present to an average of 10 percent by the year 1990.

A principal source of sediment will continue to be streambank erosion. The proposed range program will reduce the rate of streambank erosion by reducing the peak flows in streams. This will result from improved vegetative cover conditions impeding overland flow. The construction of over 1,000 ponds will also reduce peak flows, which are the most erosive. Streambank erosion is expected to decrease from its present rate of destroying approximately 170 acres annually to a loss of only 110 acres.

Construction of streambank protection was found to be infeasible. Purchase of development rights to the stream channels plus a 50 foot wide corridor along each side of the stream is proposed. Fencing this area to exclude livestock grazing would provide maximum vegetative protection to streambanks. The average annual cost of this measure is estimated at $450,000 to buy development rights to streambelts with an average width of 150 feet and to fence them.

Deer Habitat

Intensive deer habitat management on 1.6 million acres is included in the NED plan. Measures include site scarification, brush piling or crushing followed by burning, prescribed burning and herbicide spraying of brush. These measures would increase the deer population, reduce the wildfire threat, and also increase forage production for livestock. Habitat improvement investments of $56 million over a 25-year period followed by restoration and maintenance expenditures of $2.8 million would be required.

Wildfire Reduction

The average annual acreage burned by wildfire is reduced by 9,300 acres in the NED plan. Measures include increased investment in fuel treatment and fire protection equipment as well as increases in fire management employment. On an annual basis, fire management costs would increase by $4.9 million. These costs are in addition to average annual costs of $21.3 million expected under on-going programs by the year 2000. In addition to reducing the acreage burned, this plan element also reduces timber and range forage losses, reduces wildfire suppression and watershed restoration costs, improves wildlife habitat, and reduces fire-caused erosion and sedimentation.

See Table IX-3 for Land Management Comparisons of Alternative Plans.

TABLE IX-3. COMPARISON OF LAND MANAGEMENT COMPONENTS, NED AND EQ ALTERNATIVE PLANS, SAN JOAQUIN VALLEY BASIN

COMPONENTS	UNITS	NED PLAN	EQ PLAN
Developed campsites	Thousands of campsites	+4.0	+4.0
Timber production	Millions of cubic ft. per year	+24	−4
Wilderness preservation	Millions of acres	+0.2	+0.3
Range forage	Millions of AUM's per year	+3.03	+2.31
Deer habitat	Millions of acres under intensive management	+1.6	+1.6
Wildfire Reduction	Thousands of acres burned	−9.3	−13.8

ENVIRONMENTAL QUALITY (EQ) ALTERNATIVE PLAN

WATER MANAGEMENT

Flood Prevention

A 10 percent level of flood protection for 29,900 acres is proposed (100 acres more than the NED Plan). Rural communities in each of the proposed projects will receive a 1 percent level of flood protection.

The flood prevention component also involves reducing erosion on 109,500 acres of cropland and rangeland.

The structural measures proposed are reservoirs to retard flows and store sediment, and channel work and pipelines to remove runoff water (Table IX-1).

Drainage Improvement

The EQ plan proposes to improve drainage conditions by reducing the water table and soil salinity on 500,000 acres.

Along with improving drainage conditions, eight proposed projects (seven in the San Joaquin subbasin and one in the Tulare subbasin) will provide water for additional irrigation of 65,000 acres.

The proposed drainage measures will also enhance waterfowl habitat and increase fish habitat (Table IX-1).

Irrigation Improvement

In addition to drainage measures, eight projects will use water for irrigation systems on 22,000 acres.

Eight of the nine projects with irrigation benefits depend on the drainage component being installed to provide the water for irrigation of 65,000 acres of land not presently irrigated.

The measures proposed are irrigation channel work, irrigation canal lining, irrigation pipeline, and one irrigation regulating reservoir.

Other Water Management

The recreation component will provide 88,000 acres of waterfowl habitat improvement, seven multi-purpose reservoirs, and four miles of fishing access to streams. This is accomplished within proposed projects for other components.

LAND MANAGEMENT

Developed Campsites

An additional 4,000 campsites are proposed by the year 2000. This will require an investment of about $24 million for installation and $2.4 million per year for operation and maintenance. These campsites could satisfy 2.9 million recreation visitor days of annual camping demand. Development of 4,000 campsites would require only a minimal amount of land (about 1000 acres) and could potentially reduce environmental problems associated with camping in undeveloped areas, therefore; these measures are included in the EQ plan.

Timber Production

Annual timber production would be reduced by about four million cubic feet from the level expected under ongoing programs. This reduction results from an additional withdrawal of more than 60,000 acres of National Forests timberland for wilderness preservation by the year 2000. This reduction is in addition to the more than 80,000 acres of National Forest and 20,000 acres of private timberland the River Basin Planning Staff estimates will be withdrawn under ongoing programs. Timber management intensity would not be increased above levels expected under on-going programs in this plan.

Reducing annual timber production from 80 million cubic feet to 76 million cubic feet "theoretically" would allow National Forest timber management expenditures in the Basin to be reduced by about $500,000 annually. About 22 percent of the Basin's annual timber production would be grown on private land while 78 percent would be grown on National Forests in the EQ emphasis plan.

Wilderness Preservation

The entire 2.9 million acre inventory of National Park and National Forest land having wilderness characteristics could be preserved in the EQ emphasis plan. This plan withdraws 60,000 acres of commercial forest land from the timberland base. Without an intensification in management of the remaining timberlands, timber harvests on National Forests would decline by about four million cubic feet annually.

Range Forage—All Lands

The EQ plan is designed to improve wildlife habitat and provide recreation opportunities. Land treatment measures are shown on Table IX-4.

Assuming the land treatment measures would be installed between 1980 and 1990, annual forage productivity beyond 1990 would be 4.8 million AUM's. Range forage production under this plan is increased by 2.31 million AUM's.

The average annual cost of land treatment measures is $6.1 million. The average annual cost of additional technical assistance is $173,000. The average annual benefits from installing these measures is estimated at $7.6 million.

These measures will also reduce damage from soil compaction, erosion, and sedimentation, improve deer habitat, and reduce the wildfire threat.

Range Forage—Privately Owned Lands

Land treatment measures are shown on Table IX-4. Brush in problem area 3 is not controlled. Only 50 percent of the suitable brush in problem areas 5 and 6 is converted to grass. Quail guzzlers and quail roosts are planned in problem areas 3, 5, and 6. Firebreaks, critical area planting, and recreation improvements are planned for problem area 7 (Table V-3).

Assuming the land treatment measures would be installed over the ten-year period from 1980 to 1990, annual productivity is projected to reach 4,382,000 animal unit months of grazing from 1990 into the future. This represents an annual gain of 2,149,000 animal unit months over the

projected production in the year 2000 if present trends and levels of technical assistance continue.

The increase in productivity due to the EQ plan would result in an estimated increase of 114,548,000 pounds of livestock gain worth approximately $34,400,000 in 1975 dollars. Wildlife benefits include 7,200 acres of land excluded from grazing to protect critical habitat of endangered species and 270,000 animal unit months of grazing on seeded and fertilized range.

In addition, 1,280 wildlife watering facilities and 2,550 artificial quail roosts are proposed.

The 6,700 acres of critical area plantings would be excluded from grazing and offer limited habitat for wildlife. Two hundred acres of recreation area improvements are also included. Reduced erosion and sedimentation damage would result.

Average annual cost of the land treatment measures is estimated at $6,067,000 for the Basin. Accelerated technical assistance for the ten-year application period would add another $173,000 to the average annual cost.

Average annual benefits from increased forage production, wildlife improvements, and recreation improvements are estimated at $7,561,000.

Erosion and Sedimentation

Sheet and gully erosion on the foothills will be greatly reduced by the proposed range program. The area affected by moderate to severe erosion would be reduced by 60 percent. The value of this improvement has been reflected in the improved forage production discussed under Range Forage. The amount of eroded material reaching live streams will be reduced from 25 percent at present to an average of 10 percent by the year 1990.

TABLE IX-4. RANGE FORAGE COMPONENT OF EQ ALTERNATIVE PLAN, SAN JOAQUIN VALLEY BASIN

SOLUTIONS BY RESOURCE MANAGEMENT SUBSYSTEMS	UNITS	PRIVATE LANDS	NATIONAL FOREST LANDS	BASIN TOTAL
RANGE MANAGEMENT SUBSYSTEM				
ACCESS ROADS	FT.	1,245,200	105,600	1,350,800
BRUSH MANAGEMENT	AC.	—	30,000	30,000
DEFERRED GRAZING	AC.	1,179,600	—	1,179,600
FENCING	FT.	10,091,900	15,840,000	25,931,900
FERTILIZING	AC.	848,500	15,000	863,500
PROPER GRAZING USE	AC.	3,316,300	599,000	3,915,300
RANGE SEEDING	AC.	77,700	5,800	83,500
SALTING	APPLIC.	3,800	—	3,800
STOCK TRAILS	FT.	2,273,800	—	2,273,800
WATERING DEVELOPMENT SUBSYSTEM		—	200 *a*	200 *a*
PIPELINE	FT.	3,882,600	—	3,882,600
POND	NO.	1,090	—	1,090
SPRING DEVELOPMENT	NO.	340	—	340
TROUGH OR TANK	NO.	1,960	—	1,960
WELL	NO.	90	—	90
WILDLIFE WATERING FACILITY	NO.	1,280	—	1,280
WILDLIFE MANAGEMENT SUBSYSTEM				
BRUSH MANAGEMENT	AC.	61,300	—	61,300
LIVESTOCK EXCLUSION	AC.	7,200	—	7,200
RANGE SEEDING	AC.	272,200	—	272,200
WILDLIFE UPLAND HABITAT MANAGEMENT	AC.	818,300	—	818,300
RECREATION MANAGEMENT SUBSYSTEM				
ACCESS ROADS	FT.	2,148,700	—	2,148,700
RECREATION AREA IMPROVEMENT	AC.	200	—	200
RECREATION TRAILS AND WALKWAYS	FT.	8,658,400	—	8,658,400
EROSION CONTROL SUBSYSTEM				
CRITICAL AREA PLANTING	AC.	6,700	—	6,700
LIVESTOCK EXCLUSION	AC.	6,900	—	6,900
FERTILIZING	AC.	6,700	—	6,700
FIREBREAK	FT.	8,594,800	—	8,594,800

a Water Development Subsystems not itemized.

A principal source of sediment will continue to be streambank erosion. The proposed range program will reduce the rate of streambank erosion by reducing the peak flows in streams. This will result from improved vegetative cover conditions impeding overland flow. The construction of over 1,000 ponds will also reduce peak flows which are the most erosive. Streambank erosion is expected to decrease from its present rate of destroying approximately 170 acres annually to a loss of only 110 acres.

Construction of streambank protection was found to be infeasible. Purchase of development rights to the stream channels plus a 50 foot wide corridor along each side of the stream is proposed. Fencing this area to exclude livestock grazing would provide maximum vegetative protection to streambanks. The average annual cost of this measure is estimated at $450,000 to buy development rights to streambelts with an average width of 150 feet and to fence them.

Deer Habitat

Intensive deer habitat management on 1.6 million acres is included in the EQ plan. Measures include site scarification, brush piling or crushing followed by burning, prescribed burning, and herbicide spraying of brush. These measures would increase the deer population, reduce the wildfire threat, and also increase forage production for livestock. Habitat improvement investments of $56 million over a 25 year period followed by restoration and maintenance expenditures of $2.8 million would be required. These measures are the same as in the NED plan.

Wildfire Reduction

The average annual acreage burned by wildfire is reduced by 13,800 acres. Measures include increased investment in fuel treatment and fire protection equipment as well as increases in fire management employment. On an annual basis, fire management costs would increase by $9.8 million. These costs are in addition to average annual costs of $21.3 million expected under ongoing programs by the year 2000. In addition to reducing the acreage burned, this plan element also reduces timber and range forage losses, reduces wildfire suppression and watershed restoration costs, improves wildlife habitat, and reduces fire-caused erosion and sedimentation.

See Table IX-3 for land management comparisons of alternative plans.

RANGE SITE IMPROVEMENT OPPORTUNITIES

IMPROVEMENT OPPORTUNITIES

- Management Practices Only
- Reseeding and Fertilizing
- Brush Management, Reseeding and Fertilizing
- Not Considered Available for Improvement (Includes Publicly Administered Range Sites)

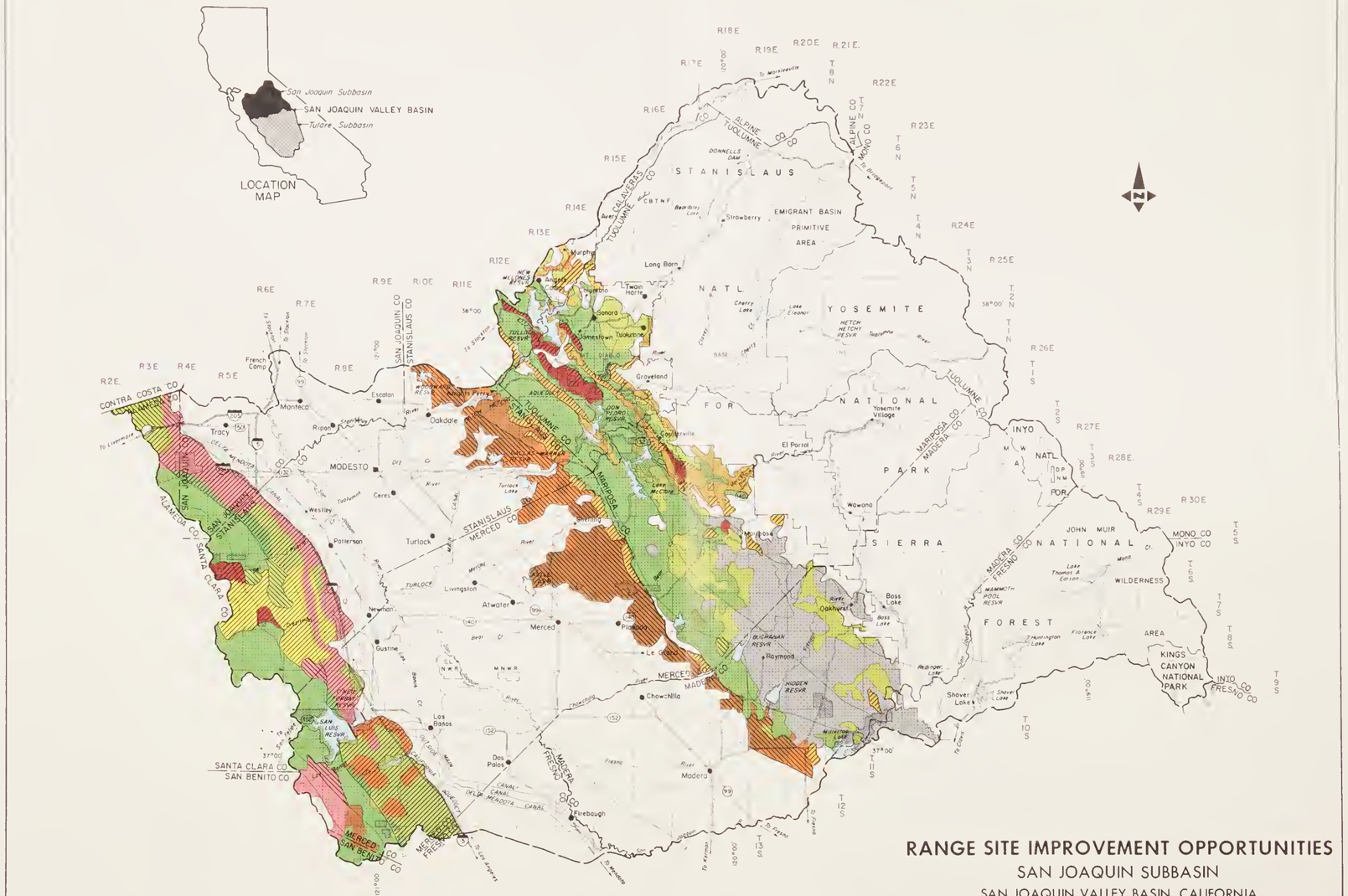
RANGE SITES

- Loamy
- Shallow Loamy
- Shallow Coarse Loamy
- Very Shallow Loamy
- Clayey
- Claypan
- Terrace
- Serpentine
- Granitic
- Not Considered A Range Site

- Water
- National Forest Boundary
- Mean Annual Precipitation (Inches)

= 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carto Unit from California State Staff compilation.
Thematic detail compiled by California State Staff.



RANGE SITE IMPROVEMENT OPPORTUNITIES

SAN JOAQUIN SUBBASIN

SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

10 0 10 20 MILES

SCALE 1-1,140,000

10 0 10 20 30 KILOMETERS

M7-SN-23488-8

RANGE SITE IMPROVEMENT OPPORTUNITIES

IMPROVEMENT OPPORTUNITIES

- Management Practices Only
- Reseeding and Fertilizing
- Brush Management, Reseeding and Fertilizing
- Not Considered Available for Improvement (Includes Publicly Administered Range Sites)

RANGE SITES

- Loamy
- Shallow Loamy
- Fine Loamy
- Shallow Coarse Loamy
- Very Shallow Loamy
- Clayey
- Claypan
- Terrace
- Serpentine
- Granitic
- Not Considered A Range Site

- Water
- National Forest Boundary
- Mean Annual Precipitation (Inches)

□ = 50,000 ACRES

Source:
Base map prepared by SCS, Portland Carto Unit from California State Staff compilation.
Thematic detail compiled by California State Staff.

RANGE SITE IMPROVEMENT OPPORTUNITIES
TULARE SUBBASIN
SAN JOAQUIN VALLEY BASIN, CALIFORNIA

JUNE 1975

SCALE 1:1,140,000

10 0 10 20 MILES

10 0 10 20 30 KILOMETERS

chapter X preferred plan four account display

san joaquin valley basin study

RANGELAND IMPROVED BY LANA VETCH PLANTING

chapter X preferred plan four account display

san joaquin valley basin study

The Preferred Plan is evaluated in terms of four accounts: National Economic Development (NED), Environmental Quality (EQ), Regional Development (RD), and Social Well Being (SWB).

The four accounts are presented in this chapter (Tables X-1 to X-7).

TABLE X-1. NATIONAL ECONOMIC DEVELOPMENT ACCOUNT, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

COMPONENTS	MEASURE OF EFFECTS	COMPONENTS	MEASURE OF EFFECTS
Beneficial Effects	(Average Annual)	Adverse Effects	(Average Annual)[1]
A. The Value to Users of Increased Outputs of Goods and Services:		A. The Value of Resources Required for the Plan:	
Water Management		*Water Management*	
1. Flood Prevention	$ 3,453,000	1. Flood Prevention	$ 2,808,000
2. Drainage Improvement	34,156,000	2. Drainage Improvement	8,080,000
3. Irrigation Improvement	1,172,000	3. Irrigation Improvement	757,000
4 Other Water Management	853,000	4. Other Water Management	195,000
5. Utilization of Unemployed or Underemployed Labor Resources	734,000	5. Associated Costs	9,049,000
Land Management		*Land Management*	
6. Developed Campsites	$ 5,800,000	6. Developed Campsites	$ 4,600,000
7. Timber Production	0	7. Timber Production	500,000
8. Range Forage	9,700,000	8. Range Forage	6,900,000
9. Deer Habitat	3,900,000	9. Deer Habitat	6,400,000
10. Wildfire Reduction	5,400,000	10. Wildfire Reduction	4,900,000
		B. Losses in Output Resulting from external diseconomies.	0
Total Beneficial Effects	$65,168,000	Total Adverse Effects	44,189,000
		Net Beneficial Effects	$20,979,000

[1]Installation cost amortized for:
100 Years at 6⅜ percent interest, except Developed Campsites, Timber Production, Deer Habitat and Wildfire Reduction which are 20 years at 6⅜ percent interest.

TABLE X-2. WATER MANAGEMENT COMPONENTS, ENVIRONMENTAL QUALITY ACCOUNT, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

BENEFICIAL AND ADVERSE EFFECTS	MEASURES OF EFFECTS
A. Areas of Natural Beauty	1. Project output will make available regional funds and resources that can be used to enhance the physical appearance on 607,000 acres. 2. Create ponds and reservoirs with a total surface area of 9,270 acres. 3. Improve 434 miles of natural earth channels. 4. Permanently inundate 9,270 acres of crop and pasture land, and wildlife habitat. 5. Convert 19 miles of earth canals to concrete lined canals.
B. Quality consideration of water, land and air resources.	1. Improve drainage and irrigation on 512,800 acres of irrigated cropland to maintain full agricultural production. 2. Increase green area by irrigating an additional 65,300 acres which will increase air oxygen content and reduce dust particles in the air by stabilizing the soil surface. 3. Decrease salt added to cropland soil and groundwater by 501,000 tons annually. 4. Add 261,000 tons of salt annually to the river system. 5. Reduce erosion on 109,500 acres. 6. Reduce flooding on 85,600 acres of cropland and rural communities.
C. Biological resources and selected ecosystems	1. Increase Type 1 Wetlands by 12,700 acres. 2. Increase Type 2 and 3 Wetlands by 30,800 acres. 3. Increase Type 4 and 5 Wetlands by 2,300 acres. 4. Enhance food supply and nesting area for migratory waterfowl on 92,500 acres. 5. Provide an additional 39,700 acres of waterfowl ponds during the months of September through March. 6. Provide an additional 3,672 acres of ponds for fish habitat.
D. Irreversible or irretrievable commitments	1. Inundate 3,300 acres of cropland and wildlife habitat. 2. Convert 19 miles of earth channels to concrete lined canals. 3. Conversion of 6,500 acres of crop and pasture land to dams, spillways, ponds and canals.

TABLE X-3. LAND MANAGEMENT COMPONENTS, ENVIRONMENTAL QUALITY ACCOUNT, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

BENEFICIAL AND ADVERSE EFFECTS	MEASURES OF EFFECTS
A. Areas of Natural Beauty	1. Creates 1,090 farm ponds with a total surface area of 1,090 acres. 2. Permanently inundate 1,090 acres of annual range. 3. Preserves 2,900,000 acres of wilderness. 4. Campgrounds will be developed on 1,000 acres of land
B. Quality consideration of water, land and air resources	1. Erosion will be reduced by critical area planting on 6,700 acres and improved plant cover on rangeland. 2. Sediment damage will be reduced by improved plant cover and ponds that will reduce peak runoff flows. 3. Increased timber management intensity on 620,000 acres will increase the frequency of harvest as well as the noise, dust, erosion and sedimentation associated with timber harvests. 4. The average annual acreage burned by wildfire will be reduced by 9,300 acres, thereby reducing smoke, erosion and sedimentation. 5. Erosion and sedimentation will increase in the first year following brush conversion, but water yield will be increased.
C. Biological resources and selected ecosystems.	1. Intensively manage 1,600,000 acres of brush land for deer and Tule Elk. 2. Wildlife water developments, artificial quail roosts and upland game management will increase quail population. 3. Create 500 ponds suitable for warmwater fish. 4. Convert 233,500 acres of brush to grass and legumes. 5. Grazing will be excluded from 7,200 acres to protect habitat for rare and endangered species.
D. Irreversible or irretrievable commitments	1. Convert 1,090 acres of rangeland to water by pond development. 2. Old growth timber will be replaced by young growth on 1,600,000 acres of land managed for timber production.

TABLE X-4. SUMMARY COMPARISON BETWEEN THE PREFERRED PLAN AND OTHER ALTERNATIVE PLANS, SAN JOAQUIN VALLEY BASIN

ACCOUNTS	UNITS	PLAN A NATIONAL ECONOMIC DEVELOPMENT	PLAN B ENVIRONMENTAL QUALITY	PLAN C PREFERRED PLAN	DIFFERENCE (PLAN C MINUS ALTERNATIVE SHOWN) PLAN A (NED)	PLAN B (EQ)
1. National Economic Efficiency						
Beneficial Effects	Dollars	84,434,000	62,565,000	65,168,000	−19,266,000	+2,603,000
Adverse Effects	Dollars	33,143,000	43,632,000	44,189,000	+11,046,000	+ 557,000
Net Beneficial Effects	Dollars	51,291,000	18,933,000	20,979,000	−30,312,000	+2,046,000
2. Environmental Quality Beneficial and Adverse Effects						
A. Developed Campsites	acres	1,000	1,000	1,000	same	same
B. Intensified Timber Management	acres	620,000	0	620,000	same	+620,000
C. Wilderness Preservation	acres	200,000	300,000	300,000	+100,000	same
D. Range-livestock and wildlife ponds	acres	1,090	1,090	1,090	same	same
E. Wildlife watering facilities	number	0	1,276	577	+577	−699
F. Intensive deer habitat Management	acres	1,600,000	1,600,000	1,600,000	same	same
G. Reduce annual acreage burned by wildfire	acres	9,300	13,800	9,300	same	−4,500
H. Create Ponds and Reservoirs for Natural Beauty and Human Enjoyment	surface acres	9,320	10,430	9,270	−50	−1,160
I. Increase Green Area by Irrigating Additional Land	acres	65,990	65,990	65,990	same	same
J. Improve Natural Earth Channels	miles	417	189	434	+17	+245
K. Improve Drainage to Reduce High Ground Water and Soil Salinity to Maintain Full Agricultural Production	acres	500,000	500,000	500,000	same	same
L. Create Ponds for Fish Habitat	surface acres	3,822	4,044	2,972	−850	−1,072
M. Develop Earth Channels for Fish Habitat	miles	28	16	13	−15	−3
N. Increase Waterfowl Habitat	surface acres of ponds	3,350	2,570	2,500	−850	−70
O. Enhance Food Supply and Nesting Area for Waterfowl	acres	91,000	88,000	91,000	same	+3,000
P. Inundate Cropland	acres	9,290	8,190	9,420	+130	+1,230
Q. Reduce Erosion on Cropland and Range Land	acres	109,500	109,500	109,500	same	same
R. Reduce Flooding of Cropland and Rural Communities	acres	60,400	56,800	60,400	same	+3,600
3. Regional Development State of California						
A. Income:						
Beneficial Effects	Dollars	88,256,000	66,217,000	69,538,000	−18,718,000	+ 3,321,000
Adverse Effects	Dollars	27,722,000	36,362,000	27,251,000	− 471,000	− 9,111,000
Net Beneficial Effects	Dollars	60,534,000	29,855,000	42,287,000	−18,247,000	+12,432,000
B. Employment Net Beneficial Effects		6635 semiskilled jobs for 10 years	8509 semiskilled jobs for 10 years	7307 semiskilled jobs for 10 years	+672 semiskilled jobs for 10 years	−1202 semiskilled jobs for 10 years
4. Social Well-Being						
A. Create Low to Medium Income Permanent Jobs		3632 jobs per year	3657 jobs per year	3146 jobs per year	−486 jobs per year	−511 jobs per year
B. Life, health, safety, reduced average annual acreage burned by wildfire		9,300	13,800	9,300	same	−4,500
C. Recreational opportunities number of recreation days of camping, deer hunting, and viewing		3,300,000	3,300,000	3,300,000	same	same

TABLE X-5. REGIONAL DEVELOPMENT ACCOUNT, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

COMPONENTS	MEASURES OF EFFECTS CALIFORNIA	REST OF NATION
Beneficial Effects	(Average Annual)	
A. The value of increased output of goods and services to users residing in the region.		
Water Management		
1. Flood Prevention	3,453,000	0
2. Drainage Improvement	34,156,000	0
3 Irrigation Improvement	1,172,000	0
4 Other Water Management	852,000	1,000
5. The utilization of regional unemployed or under employed labor resources.		
Project Construction and OM&R	672,000	0
Land Management		
6. Developed Campsites	$ 2,900,000	$2,900,000
7. Timber Production	0	0
8. Range Forage	9,300,000	4,400,000
9. Deer Habitat	3,900,000	0
10 Wildfire Reduction	2,300,000	3,100,000
B. The value of output to users residing in the region from external economies.		
1. Indirect activities associated with increased net returns		
Water Management		
a Flood Prevention	283,000	0
b. Drainage Improvement	3,710,000	0
c. Irrigation Improvement	100,000	0
d Other Water Management	83,000	0
Land Management		
e. Developed Campsites	1,400,000	−1,400,000
f. Timber Production	0	0
g. Range Forage	1,400,000	−1,400,000
h. Deer Habitat	200,000	−200,000
i. Wildfire Reduction	3,600,000	−3,600,000
2. Indirect and induced activities associated with utilization of regional unemployed and under-employed and other labor resources.		
Farm Hired Labor	57,000	0
Total Beneficial Effects	$69,538,000	$3,801,000

COMPONENTS	MEASURE OF EFFECTS CALIFORNIA	REST OF NATION
Adverse Effects	(Average Annual)[1]	
A. The value of resources contributed from within the region to achieve the outputs.		
Water Management		
1. Flood Prevention	961,000	1,847,000
2. Drainage Improvement	4,675,000	3,406,000
3. Irrigation Improvement	473,000	284,000
4. Other Water Management	195,000	0
5. Associated Costs	9,047,000	0
Land Management		
6. Developed Campsites	$ 2,300,000	$ 2,300,000
7. Timber Production	400,000	100,000
8. Range Forage	6,600,000	300,000
9. Deer Habitat	0	3,900,000
10. Wildfire Reduction	2,600,000	2,300,000
Total Adverse Effects	$27,251,000	$14,437,000
Net Beneficial Effects	$42,287,000	−$10,636,000

[1]Installation cost amortized for 100 years @ 6⅜ percent interest, except Developed Campsites, Timber Production, Deer Habitat and Wildfire Reduction which are 20 years at 6⅜ percent interest.

TABLE X-6. EMPLOYMENT EFFECTS, REGIONAL DEVELOPMENT ACCOUNT, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

BENEFICIAL EFFECTS	MEASURE OF EFFECTS[a] CALIFORNIA	ADVERSE EFFECTS	MEASURES OF EFFECTS[a] CALIFORNIA
Increase in Number and types of jobs		Decrease in Number and types of jobs	
1. Agricultural Employment	1. Utilizes 2456 man years of employment in Agriculture on a permanent basis	1. Lost in agricultural employment of project take area	1. 6 man years of agricultural employment
2. Timber Industry Employment	2. —	2. —	2. —
3. Fire Management Employment	3. 390 permanent semiskilled jobs	3. —	3. —
4. Recreation Employment	4. 370 permanent seasonal jobs in recreation	4. —	4. —
5. Employment for Project Construction	5. 2304 semiskilled jobs for 10 year construction period	5. Lost in indirect and induced employment associated with project take area	5. 3 permanent semiskilled jobs
6. Employment for Project OM&R	6. 75 permanent seasonal semiskilled jobs		
7. Employment in Land Treatment Construction	7. 4,287 semiskilled jobs for 10 year construction period		
8. Employment in Land Treatment OM&R	8. 38 permanent seasonal semiskilled jobs		
9. Indirect and induced employment for construction and output of project's goods and services	9. 1078 permanent semiskilled jobs		
TOTAL BENEFICIAL EFFECTS	3155 permanent semiskilled jobs 536 permanent seasonal semiskilled jobs 7307 semiskilled jobs for 10 year construction period	TOTAL ADVERSE EFFECTS	9 permanent semiskilled jobs
		NET BENEFICIAL EFFECTS	3146 permanent semiskilled jobs 536 permanent semiskilled seasonal jobs 7307 semiskilled jobs for 10 year construction period

aNo effects on Rest of Nation

TABLE X-7. SOCIAL WELL-BEING ACCOUNT, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

BENEFICIAL AND ADVERSE EFFECTS:	MEASURE OF EFFECTS	
	Land Management	*Water Management*
A. Real Income Distribution	1. Creates 1,777 medium income jobs for Basin residents.	1. Creates 3,302 low to medium income jobs for Basin residents.
B. Life, Health and Safety	1. Reduces the wildfire threat. The average annual burn is expected to be reduced by 9,300 acres.	1. Provide a 10 percent level of flood protection for 29,800 acres of land and 1 percent level of protection for the rural communities in each of the proposed projects.
C. Recreational Opportunities	1. Creates opportunities for 2.9 million days of camping, nearly 370,000 recreation days of deer hunting and viewing and provides fishing and wildlife observation opportunities at watering facilities and ponds.	1. Recreational opportunities will be improved by enhancement of 90,900 acres of waterfowl habitat and development of 2,972 acres of fish habitat.

chapter XI basinwide linear programming model

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WATER MEASUREMENT IS A KEY TO MANAGEMENT

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Analytical Model

Two subbasin linear programming models, the San Joaquin and Tulare respectively, were developed by the River Basin Planning Staff during the study. These analytical models contain specific cropping activities, on-farm production costs, prices, and net returns for each crop on a specific soil group basis. Twenty-nine crops were considered in the adequately, partially, or poorly drained condition for both the west and east side of each subbasin on a soil group basis. This resulted in about 1,500 activities for each subbasin model. Input levels for each activity were specified for irrigation water use, fertilizer use, fuel use (gas and diesel), and labor hours (harvest and non-harvest) on a per acre basis. Yield levels and on-farm production costs were also on an activity basis.

The objective function value for each subbasin model was the net returns to agriculture subject to constraints on certain resource availabilities for the specific target year (*Base, 1985,* and *2000*). Land constraints included the acreage of land available on a soil group basis by drainage condition, side of the subbasin, and irrigation suitability. In the base year, an estimate was made of irrigated land acreage on a subbasin, soil group, side, and drainage condition basis.

In future years, urbanization of existing irrigated lands was estimated on a subbasin, soil group, side, and drainage condition basis (Table XI-1). The future availability of new irrigated lands was also estimated and these were allowed to enter the solution at a development cost specific to each soil group. Irrigation water supplies were estimated for each target year on the basis of side, source (surface or groundwater), critical month (July), and total annual supply. Average farm operator water costs on an acre-foot basis were estimated by subbasin and side for both surface and groundwater sources.

Underlying all the analysis was the requirement that the average yield reality restraint (AYR) be met for both base and future years. This prevented crop production from concentrating on the highly productive and profitable soil groups and allowed a cropping pattern more like that of actual conditions.

TABLE XI-1. PROJECTED URBANIZATION OF IRRIGABLE LAND, SAN JOAQUIN AND TULARE SUBBASINS, SAN JOAQUIN VALLEY BASIN

		ACRES CONVERTED		
SUBBASIN	PERIOD	WESTSIDE	EASTSIDE	TOTAL
San Joaquin	1972-1985	6,100	20,300	26,400
	1985-2000	20,900	27,200	48,100
	1972-2000	27,000	47,500	74,500
Tulare	1972-1985	18,700	169,300	188,000
	1985-2000	51,800	92,800	144,600
	1972-2000	70,500	262,100	332,600
TOTAL	1972-1985	24,800	189,600	214,400
	1985-2000	72,700	120,000	192,700
	1972-2000	97,500	309,600	407,100

Source: River Basin Planning Staff estimate, October 7, 1976.

Alternatives Evaluated

Three sets of resource conditions were evaluated with respect to the 20 proposed drainage projects, 7 flood prevention projects and one irrigation project as follows:

1. DWR D-100 crop production levels with 1972 SCS on-farm irrigation water efficiencies, DWR-SCS future water supply conditions, and River Basin Planning Staff's projected irrigated land availability.

2. D-100 production levels and all other assumptions except for on-farm irrigation water use efficiency increases over 1972 of 2 percent for 1985 and 5 percent for 2000.

3. A full resource use condition in which D-100 production levels were used as lower limits or minimums, and crop production increased until either land or water resources or lack of profitability (lack of positive net returns) became the limiting factor.

Economic Effects

The drainage projects in the Preferred Plan would increase Basin net revenues immediately after their assumed installation date of 1985. If irrigation efficiency for the next 100 years remained at 1972 levels, the Basin's average annual beneficial effects would total nearly 40 million dollars (Table XI-2). This compares to about 34.2 million dollars beneficial effects if the projects are considered singly as previously displayed in the "Preferred Plan" chapter. The differences between the two estimates are due to the variance between assumptions regarding future land use, crop price, and farmer response to the drainage projects.

If D-100 production conditions hold in the future but irrigation rises as anticipated by the River Basin Planning Staff, average annual beneficial effects would increase to about 48.3 million dollars (Table XI-2). The results from relaxing the D-100 production constraints and permitting land, water, or profitability to be the limiting factor indicate an average annual net revenue increase of over 81 million dollars (Table XI-2). It should be noted that going beyond D-100 production levels with constant crop prices implies a condition which may not hold in reality because some crops, e.g., almonds, are grown primarily in the Basin and increased supplies could depress market prices.

TABLE XI-2. ECONOMIC EFFECTS OF DRAINAGE IMPROVEMENT COMPONENT, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

PRODUCTION CONSTRAINTS	IRRIGATION EFFICIENCY	NET REVENUE INCREASES (Average Annual) a
1. D-100	1972	$39,979,000
2. D-100	Increasing b	$48,300,000
3. Free c	Increasing b	$81,976,000

a 100 years at 6⅜ percent interest rate

b On-farm irrigation efficiencies projected to increase 2 percent over 1972 levels by the year 1985 and an additional 3 percent by 2000.

c D-100 production levels were used as lower limits and the analytical model distributed the production increases proportionally by tonnage until the water or land availability became the limiting resource

Crop Acreage

Twenty-nine crops were combined into the seven crop groups indicated in Table XI-3. The crop acreage between the years 1972 and 2000 is projected to increase by 13 percent with D-100 production levels and 21 percent with full resource use conditions (Tables XI-3 and XI-4).

Fruit and nuts acreages increase the most acreage-wise under both D-100 and full resource use conditions. Vegetables, roughage, and other crop acreages also increase over time. Grain acreages decline slightly under D-100, but rise slightly under full resource use conditions. Cotton acreage declines somewhat with double crops held constant over the next twenty-eight years.

TABLE XI-3. IRRIGATED ACREAGE LEVELS WITH DRAINAGE PROJECTS, D-100 PRODUCTION PROJECTIONS, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

CROP GROUP	BASE	1985	2000	CHANGE BASE TO 2000
	(Thousands of Acres)			(Percent)
Fruits and nuts	959	1133	1287	+34
Vegetables, all	214	287	345	+61
Cotton	711	620	602	−15
Grains	750	702	704	− 6
Roughages	1159	1290	1371	+18
Double crops	70	70	70	0
Other crops	496	521	562	+13
TOTAL	4359	4623	4941	+13

Notes: 1. Fruit and nuts crops include almonds, walnuts, grapes, deciduous, citrus, olives and figs.

2. Vegetable crops include those double-cropped.

3. Grain crops include barley, wheat, sorghum, corn, and rice.

4. Roughages include alfalfa hay, silage, and irrigated pasture.

5. Double crops include barley-silage and barley-sorghum.

6. Other crops include dry beans, safflower, sugar beets, non-alfalfa hay, and other crops.

Source: River Basin analytical model solutions for base period, 1985 and 2000. January and February 1977.

TABLE XI-4. IRRIGATED ACREAGE LEVELS WITH DRAINAGE PROJECTS, FULL RESOURCE USE CONDITIONS, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

CROP GROUP	BASE	1985	2000	CHANGE BASE TO 2000
	(Thousands of Acres)			(Percent)
Fruits and nuts	959	1204	1411	+47
Vegetables, all	214	304	368	+72
Cotton	711	663	645	−10
Grains	750	748	755	+ 1
Roughages	1159	1343	1437	+24
Double crops	70	70	70	0
Other crops	496	549	597	+20
TOTAL	4359	4881	5283	+21

Notes: See Table IX-3.

Source: River Basin analytical model solutions.

Irrigation Land Distribution

The types of land to be irrigated were forecast by the two models. In future years, over 90 percent of the existing lands which are not converted to non-agricultural uses are forecast to remain in production. The extent to which existing and new irrigated lands will be utilized is summarized in Tables XI-5 and XI-6.

TABLE XI-5. IRRIGATION LAND DISTRIBUTION WITH DRAINAGE PROJECTS, D-100 PRODUCTION PROJECTION, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

YEAR	EXISTING LANDS a	NEW LANDS *b*	TOTAL LAND
	(Millions of Acres)		
1970-72	4.359	0	4.359
1985	4.353	.270	4.623
2000	4.029	.912	4.941

a Classified by SCS as irrigated lands in 1972 but reduced due to urbanization in future years.

b Lands which could be irrigated if a firm water supply were to be made available in the future.

Source: River Basin analytical model solutions.

TABLE XI-6. IRRIGATION LAND DISTRIBUTION WITH DRAINAGE PROJECTS, FULL RESOURCE USE CONDITIONS, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

YEAR	EXISTING LANDS	NEW LANDS	TOTAL LAND
	(Millions of Acres)		
1970-72	4.359	0	4.359
1985	4.336	.545	4.881
2000	4.065	1.218	5.283

Notes: See Table XI-5.

Source: River Basin analytical model solutions.

Full Production Potential

The extent to which the Basin's crop production could be expanded beyond D-100 levels is displayed in Table XI-7. Generally speaking, about 6.5 to 7.4 percent more production could be obtained from the Basin if all of the assumptions used hold into the future. Some unprofitable field and grain crops would not increase nor would it be profitable to expand irrigated pasture output unless price and cost relationships were to be more favorable in the future.

TABLE XI-7. IRRIGATED LANDS PRODUCTION INCREASES D-100 AND FULL RESOURCE USE WITH DRAINAGE PROJECTS, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

CROP	INCREASE OVER D-100 LEVELS			
	1985	2000	1985	2000
	(Thousands of Tons)		(Percent)	
Fruit and nuts	465	631	6.6	7.2
Vegetables, all	272	394	6.6	7.3
Cotton	25	29	7.0	7.1
Grains	124	152	6.6	7.3
Roughages	593	787	6.4	7.4
Safflower	8	8	7.1	6.7
Seed, all	2	2	7.0	6.8
Sugar beets	250	366	6.5	7.4

Source: River Basin analytical model solutions.

Irrigation Water Use

The extent to which irrigation water will be used is displayed in Tables XI-8 and XI-9. Under D-100 conditions, improved on-farm irrigation efficiency could reduce agricultural water use demands by 0.56 million acre-feet in 1985. The reduction in the year 2000 would be even greater — 1.5 million acre-feet.

Total Basinwide water use increases during the 1972-2000 period. If D-100 production conditions were realized in the future and irrigation efficiency were improved as anticipated, the Basin's increased agricultural output could be realized with a water application increase of less than 3 percent by the year 2000. If D-100 production conditions were exceeded, the Basin could use an additional 0.6 and 0.9 million acre-feet of the projected water supplies in 1985 and 2000 respectively.

TABLE XI-8. IRRIGATION WATER USE WITH DRAINAGE PROJECTS, D-100 PRODUCTION PROJECTIONS, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

YEAR	IRRIGATION EFFICIENCY	TOTAL WATER USE (Million Acre Feet)
1972	1972	16.389
1985	1972	17.343
"	Increasing a	16.784
2000	1972	18.252
"	Increasing *b*	16.773

a An increase in on-farm irrigation efficiency of 2 percent over 1972.
b An increase in on-farm irrigation efficiency of 5 percent over 1972.
Source. River Basin analytical model solutions.

TABLE XI-9. IRRIGATION WATER USE WITH DRAINAGE PROJECTS, FULL RESOURCE USE CONDITIONS, PREFERRED PLAN, SAN JOAQUIN VALLEY BASIN

YEAR	IRRIGATION EFFICIENCY	TOTAL WATER USE (Million Acre Feet)
1972	1972	16.389
1985	Increasing *a*	17.456
2000	Increasing *b*	17.693

a An increase in on-farm irrigation efficiency of 2 percent over 1972.
b An increase in on-farm irrigation efficiency of 5 percent over 1972.
Source River Basin analytical model solutions.

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FISHING IN FARM POND

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Accelerated Erosion

See Erosion, Accelerated.

Accelerated Technical Assistance

That amount of additional manpower from a technical agency (such as the USDA — Soil Conservation Service) agreed to or needed to accomplish the application of conservation land treatment measures at a faster rate than the current, on-going level of assistance.

Anadromous Fish

Those species of fish which mature in the sea and migrate into streams to spawn. Salmon, steelhead, and shad are examples.

Animal Unit Month (AUM)

The quantity of forage required by one mature cow (1000 lbs) or the equivalent for one month.

Base Year

Initial study year frame of reference for analytical and comparative purposes by which to compare future projections. Generally in this report, the year 1972 was used, although in some cases a more recent year was considered appropriate.

Benefit-Cost Ratio

An economic indicator of efficiency, computed by dividing benefits by costs. Usually, both the benefits and the costs are discounted so that the ratio reflects efficiency in terms of the present value of future benefits and costs.

Brush

A collective term that refers to stands of vegetation dominated by shrubby, woody plants or low growing trees — regardless of whether some of the components are cropped.

Brush Management

Management and manipulation of stands of brush by mechanical, chemical, or biological means or by prescribed burning.

Comprehensive Plan

A plan for the development of an area including policies, goals, and interrelated plans for private and public land use, transportation systems, community facilities, and all other elements and features that, in composite, represent the decisions of local people.

Conservation

The development, use, and management of soil, water, and related resources in a way that will restore, enhance, protect, and maintain their quality and quantity for the benefit of man and his environment now and into the future.

Cost

The negative (adverse) effects. Costs may be monetary, social, physical, or environmental in nature.

Cost-Benefit Ratio

See Benefit-Cost Ratio

Demand

Various quantities of any particular commodity (good) or service that will be taken off a market or groups of related markets at all possible alternative prices, other things being equal. Quantity demanded of a good is affected by: (1) price of the good, (2) tastes and preferences, (3) income, (4) prices of related goods and (5) the range of goods available.

Derived Demand

The demand (schedule) for a commodity which grows out of the desire to satisfy the demand for some other commodity. The demand for housing, for example, may create a demand for lumber, bricks and many other things needed to build the housing.

Developed Campsite

Campsites that include a water system, sanitation system, parking space, table, and stove or fire ring.

Economic Base

The economic characteristics (e.g., quantities of resources, demand for products, supply of investment goods, quantity and quality of labor force, marginal capital-output ratio, production relationships, stage of development of the region) that contribute to the region's income and growth and economic trends and cycles of the region. The economic base considers: (1) basic activities which produce and distribute goods and services for export and (2) service activities whose goods and services are consumed within the region.

Endangered Species

See Species, Endangered.

Environment

The complex of climatic, soil, and biotic factors that act upon an organism or ecological community and ultimately determine its form and survival.

Environmental Quality (EQ)

Enhancing environmental quality by the management, conservation, preservation, creation, restoration or improvement of the quality of certain national and cultural resources and ecological systems is one of the two main objectives for programs involving water and related land resources administered by Federal agencies whose activities involve planning and development of water resources.

Erosion

The group of processes whereby earthy or rock material is worn away, loosened or dissolved and removed from any part of the earth's surface. It includes the processes of weathering, dissolution, abrasion, corrosion and transportation.

Erosion, Accelerated

Erosion that can be attributed directly or indirectly to the activities of man.

Flood

An overflow or inundation that comes from a river or other body of water and causes or threatens to cause property damage.

Forage

That part of the current leaf and twig growth of shrubs, woody vines and trees available for animal consumption and nonwoody plants that are available to livestock or game animals used for grazing or harvested for feed.

Forb

Any herbaceous plant other than those in the Gramineae (true grasses), Cyperaceae (sedges) and Juncaceae (rushes) families — i.e., any nongrass-like plant having little or no woody material on it.

A palatable, broad-leaved, flowering herb whose stem, above ground, does not become woody and persistent.

Forest

Generally, an ecosystem characterized by a more or less dense and extensive tree cover.

More particularly, a plant community predominately of trees and other woody vegetation, growing more or less closely together.

Grazing, Deferred

Discontinuance of grazing by livestock on an area for a specified period of time during the growing season to promote plant reproduction, establishment of new plants, or restoration of vigor by old plants.

Groundwater Table

See Water Table.

Habitat

The natural place of abode of a plant or other organism. The locality where the organism may generally be found, and where all essentials for its development and existence are present. A geographical niche. Habitats are described by their geographical boundaries or with such terms as "shady woodland," "banks of streams," or "dry hillsides."

Improved Potential

The increased forage production capability of a soil with natural vegetation or introduced species due to the addition of essential plant elements such as nitrogen, phosphorus, potassium, sulfur, etc. The improvement is generally 200 to 300 percent.

Interdisciplinary Team

A group of individuals with different training assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to adequately solve the problem. The members of the team proceed to solutions with frequent interaction so that each discipline may provide insights to any stage of the problem and disciplines may combine to provide new solutions. This is different from a multidisciplinary team where each specialist is assigned a portion of the problem and their partial solutions are linked together at the end to provide the final solution.

Land Capability

The inherent ability of land to be used without permanent damage. Land capability, as ordinarily used in the United States, is an expression of the effect of physical land conditions, including climate, on the total ability to be used without damage for crops that require regular tillage, for grazing, for woodland, and for wildlife.

Land capability involves consideration of (1) the risks of land damage from erosion and other causes and (2) the difficulties in land use owing to physical land characteristics, including climate.

Linear Programming Model

A mathematical method used to determine the most effective allocation of limited resources between competing demands when both the objective (e.g., profit or cost) and the restrictions on its attainment are expressible as a system of linear equalities or inequalities.

Low Soil Fertility

That condition when the available amounts of one or more essential plant elements such as nitrogen, phosphorus, potassium, sulfur, etc. in the soil are less than that needed to maintain vegetation at its natural potential.

Market Place

The place all potential buyers and sellers of all goods and services come together, express their desires and offer their wares, through bargaining establish a price structure and production schedule, and complete their transactions. In standard usage it refers to all locations where economic transactions occur.

National Economic Development (NED)

One of the two main objectives of planning for water and related land resources by Federal agencies whose activities involve planning and development of water resources.

Reflects increases in the Nation's productive output, an output which is partly reflected in a national product and income accounting framework to measure the continuing flow of goods and services into direct consumption or investment.

Natural Potential

The highest forage production capability of a soil with natural vegetation or introduced species that has not been treated with essential plant elements such as nitrogen, phosphorus, potassium, sulfur, etc.

Net Benefit

The net gain from goods and services that improve the welfare of the community as a whole. The net gain is the resultant of all public and private gains and losses.

Normalized Prices

The long-term trend of prices, that are expected to be in effect after adjustment for seasonal and cyclical fluctuation. Can also be the average price over a series of three or more years.

OBERS Projections

National, regional, and subregional demand schedule projections produced by the Office of Business Economics (OBE) (now called the Bureau of Economic Analysis) and Economic Research Service (ERS) under the direction of the Water Resources Council (WRC). These economic projections are available in the WRC "1972 OBERS projections," and present the Council's current views as to probable rates of Gross National Product (GNP), employment, productivity, and other factors.

Part Per Million (ppm)

One part by weight of dissolved chemical, or suspended sediment, in 1 million parts by weight of water.

Percolation

The downward movement of water within a soil, especially the downward flow of water in saturated or nearly saturated soil.

PL 566 Projects

Projects authorized by the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, as amended) allow the U.S. Department of Agriculture to assist sponsoring local organizations plan and carry out a program for the development, use, and conservation of the Nation's soil and water resources. The primary purpose must be flood prevention, irrigation, or drainage; other purposes such as recreation, fish and wildlife development, municipal and industrial water supply, and other soil and water management measures may also be included. The project must cover a watershed or subwatershed area of not more than 250,000 acres. No structure providing more than 12,500 acre-feet of floodwater detention capacity or more than 25,000 acre-feet of total capacity may be included. Except for land rights, the program may provide federal cost-sharing of all installation costs for flood prevention, and up to 50 percent of installation costs for all other purposes, except municipal and industrial water supply.

Pollution

Any substance or energy form (heat, light, noise, etc.) which alters the state of the environment from what would naturally occur. Especially associated with those altered states which human value judgments have decreed as undesirable.

Primitive Areas

A large tract within a U.S. National Forest set aside for preservation in near natural condition with no alteration or development.

Quail Guzzler

A buried water storage facility supplied by runoff from an adjacent runoff collecting area. Furnishes drinking water only to quail or other bird species.

Range

All land producing naturalized or native forage for animal consumption, and lands that are revegetated naturally or artifically to provide a forage cover that is managed like native vegetation.

Recreation

Leisure time activity such as swimming, picnicking, boating, hunting and fishing.

Recreation Visitor Day

See Visitor Day.

River Basin

See Watershed.

River Basin Plan

One of the "levels of planning" for water and related land resources planning by Federal agencies whose activities involve planning and development of water resources as contained in the Principles and Standards of the U.S. Water Resources Council.

Reconnaissance-level evaluations of water and land resources for selected areas are performed under planning authorities of Public Law 83-566 and Public Law 87-639. They are directed toward resolving the complex problems identified by framework studies and assessments or other Federal-state investigations and terminate in a recommended plan or disclosure of possible alternative plans. They may vary widely in scope and detail; will consider present and long-range problems with a focus on middle term (15 to 25 years) needs and desires; and will involve interested Federal, state, and local entities.

Share of the Market, Current Share

The average production level for the last five years for the San Joaquin Valley Basin, San Joaquin Subbasin and Tulare Subbasin, expressed as a percentage of the total United States production and California production.

Social Benefits

The net benefit considerations of long-range societal values at the regional or national level which might not be taken into account in the profit and loss statement of an individual farmer, forest operator, industrialist or other private citizen.

The non-monetary and rarely quantifiable returns to society arising from any form of economic activity — e.g., those recreational benefits resulting from the creation of a scenic overlook.

Social Well-Being

One of the four required accounts for categorizing, displaying, or accounting the beneficial and adverse effects of each alternative plan formulation for water and related land resources planning specified in the Water Resources Council's Principles and Standards and the U.S. Department of Agriculture's Procedures. The "social well-being" account includes (at least): (1) real income distribution among individuals, classes, and groups; (2) life, health, and safety; (3) education, cultural, and recreational opportunities; and (4) emergency preparedness.

Soil

The loose surface material of the earth, usually consisting of disintegrated rock with an admixture of organic matter and soluble salts.

The collection of natural bodies occupying portions of the earth's surface that support plants and that have properties due to the integrated effect of climate and living matter, acting upon parent material, as conditioned by relief, over periods of time.

Soil Group

A broad grouping of soils that have similar cropping patterns, yield characteristics, responses to fertilizers, management, and land treatment measures.

Species, Endangered

A species (or subspecies) is determined endangered by the California Department of Fish and Game if one or more the following conditions exist: (1) Its mortality rate consistently exceeds its birth rate, (2) has an incapacity to adapt to environmental change, (3) its habitat is threatened by destruction or serious disturbance, (4) its survival is threatened by the unwanted introduction of other species through predation, competition, or disease, or (5) its survival is threatened by environmental pollution.

Species, Rare

A species is considered rare by the California Department of Fish and Game if it is: (1) confined to a relatively small and specialized habitat, or incapable of adapting to different environmental conditions, (2) is not abundant anywhere, although found in other parts of the world, (3) is so limited that any appreciable reduction in range, numbers, or habitat would cause it to become endangered, or (4) would become endangered if current management and protection programs were diminished to any degree.

While the term "endangered" relates to the probability of species extinction throughout all or a portion of its range, the term "rare" is used to label those species likely to become endangered.

Suitability

In land use planning literature the widely used terms "suitability" and "capability" (whether alone or accompanied by various modifers) are often used interchangeably to refer to ratings based on two basically different evaluation procedures. One basic type of evaluation procedure is the rating of use or productivity potentials based on the present state of the resource. This type of rating therefore is an evaluation based on the resource's inherent, natural or intrinsic ability to provide for use and includes that existing ability which is the result of past alterations or current management practices. A second basic type of evaluation procedure rates the potential ability of a resource to produce goods or services on the basis of the maximum possible outputs for a given type and level of future, alternative site or resource management inputs.

Supply

Various quantities of any particular commodity (good) or service that a seller or sellers will place on a market or groups of markets at all possible alternative prices, other things being equal. It is the relationship between prices and quantities, per unit of time, that sellers are willing to sell.

Visitor Day

The use of an area for a total of 12 person-hours by one or more people, either continuously or spread over several visits.

Water Pollution

Any substance or energy form (heat, light, noise, etc.) which alters the state of a body of water from what would naturally occur. Especially associated with those altered states which human value judgements have decreed as undesirable.

Watershed

The total area above a given point on a stream that contibutes water to the flow at that point.

The entire region drained by a waterway or which drains into a lake or reservoir.

Watershed Investigation (WI)

A preliminary study of possible PL 566 projects to identify the potential for full development of water and related land resources. A watershed investigation report (WIR) is used to determine that watershed developments proposed for early action programs or other departmental authorization are feasible. The investigations and data provide an adequate basis to support and justify a request for authorization.

Watershed Management

The management of all the natural resources of a watershed to protect, maintain, or improve its water yields.

Watershed Protection

The combination of complementary practices of land treatment and structural works to maintain or improve total yield, quality, stability of flow of surface and subsurface water, and prevention of damage and loss due to excessive and uncontrolled runoff, flooding, salination, and siltation.

Water Table

The upper surface of a local zone of soil water saturation held above the main body of groundwater by an impermeable layer or stratum, (usually clay) and separated from the main body of groundwater by an unsaturated zone.

Wetlands

Areas that are permanently wet, or intermittently water-covered, such as swamps, marshes, bogs, muskegs, potholes, swales, glades, and overflow land of river valleys. Large, open lakes are commonly excluded, but many kinds of ponds, pools, sloughs, holes, and bayous may be included.

Wetland Type 1

Seasonally flooded basins or flats in inland fresh areas where the soil is covered with water, or is water logged, during variable seasonal periods but usually is well drained during much of the growing season.

Wetland Type 2

Inland fresh meadows where the soil usually is without standing water during most of the growing season but is water logged within at least a few inches of its surface.

Wetland Type 3

Inland shallow fresh marshes where the soil is usually water logged during the growing season; often it is covered with as much as 6 inches or more of water.

Wetland Type 4

Inland deep fresh marshes where the soil is covered with 6 inches to 3 feet or more of water during the growing season.

Wetland Type 5

Inland open fresh water including shallow ponds and reservoirs where the water is usually less than 10 feet deep and is fringed by a border of emergent vegetation.

Wilderness

Land areas that have little or no evidence of human use, other than foot or pack animal trails. This is a broader definition than found in the Wilderness Act.

Wildfire

A free-burning fire. Any fire other than a controlled burn or a prescribed burn occurring on wildland.

Wildland

Extensive land areas managed and developed to utilize the existing resources and uses in more or less their natural condition. A broad term indicating relatively undeveloped lands as opposed to lands developed for cultivation, crops, improved pasture, urban development and industrial sites.

Wildlife

Undomesticated vertebrate animals, except fish, considered collectively.

Wildlife and Fish Habitat System

U.S. Forest Service Service usage. This system protects and improves wildlife and fish habitat with special emphasis on threatened and endangered species. Management of wildlife and fish habitats is closely coordinated with the states because they control wildlife and fish populations. This coordination includes (1) close working relations among National Forest, State, and private land managers; (2) cooperative forestry programs designed to assist non-Federal land managers; and (3) research programs that define environmental requirements of fish and wildlife and provide management alternatives through which these requirements can be attained.

Wildlife Watering Facility

A constructed device that provides drinking water for wildlife. See also Quail Guzzler.

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